INTERMOUNTAIN WEST
JOINT VENTURE
conserving habitat through partnerships

INTERMOUNTAIN WEST JOINT VENTURE

Implementation Plan

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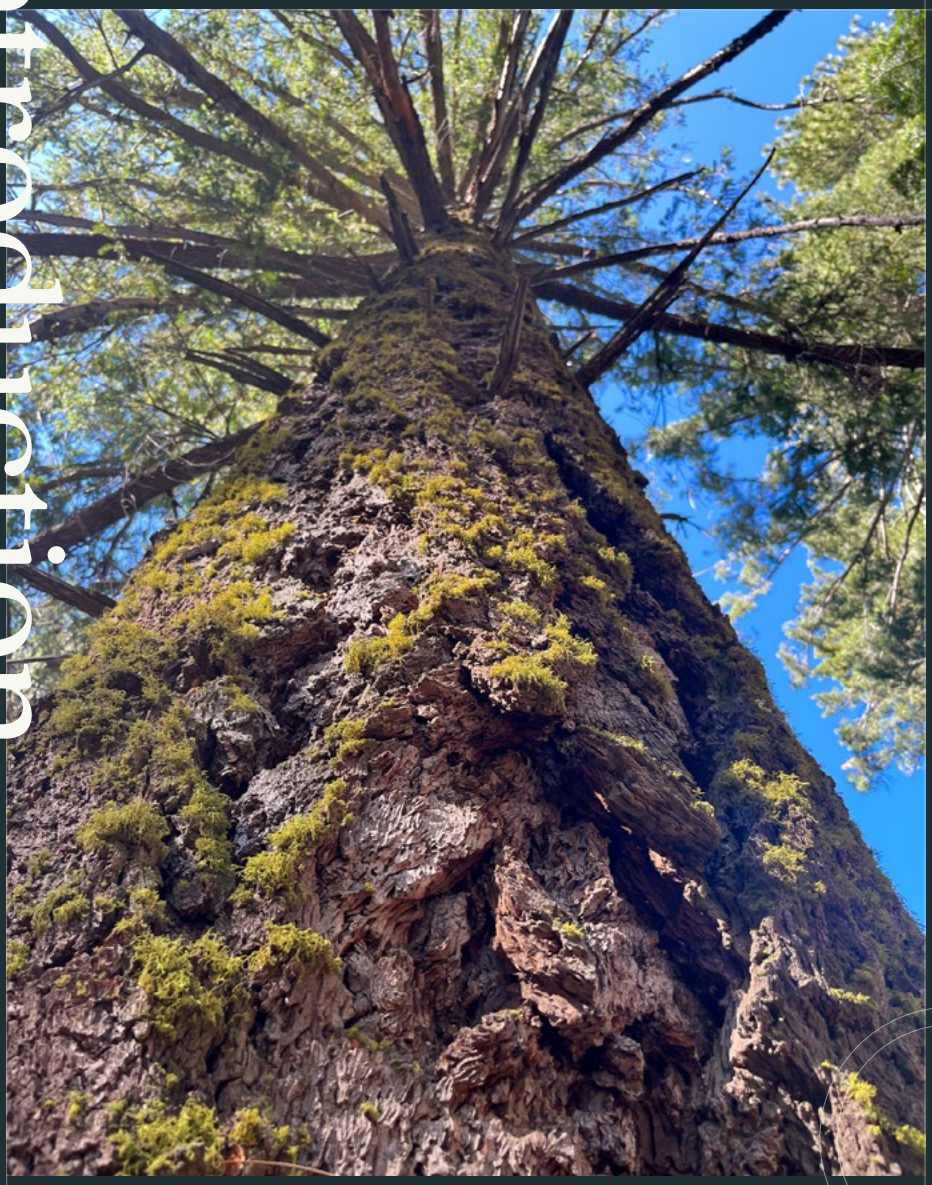
Acronym Glossary

ACEP-ALE	Agricultural Conservation Easement Program–Agricultural Lands Easements
BLM	Bureau of Land Management
IWJV	Intermountain West Joint Venture
NAWMP	North American Waterfowl Management Plan
NRCS	Natural Resources Conservation Service
RCPP	NRCS's Regional Conservation Partnership Program
SONEC	Southern Oregon–Northeastern California
SWM	Surface Water Monitoring
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WET	Wetland Evaluation Tool

Introduction



Our Mission

Conserve and enhance bird habitats at meaningful scales through capacity building, science, communications, and strategic partnerships.

Our Vision

An Intermountain West where people, birds, and other wildlife thrive.

The Intermountain West Joint Venture (IWJV) has evolved immensely over the last decade. While the *conserving and enhancing bird habitats* component of our mission is at the core of everything the IWJV has engaged in since its inception in 1994, the ways we support the partnership in achieving this mission include new elements that stretch the boundaries of the 30-plus-year Migratory Bird Habitat Joint Venture enterprise.

The IWJV is rooted in bird habitat conservation, and that remains central to our mission. However, to be successful, we have adapted our conservation approach over the last decade. Today, we see our work through a lens of relevance to people.

This philosophy is embedded in our vision and is reflected throughout the bird conservation community. The modern iterations of the North American Waterfowl Management Plan, Partners in Flight, and the North American Bird Conservation Initiative all speak to the importance of people. In the last two decades, the IWJV has made its mark by operationalizing people-centric conservation approaches. We have concluded that we must work in ways that can drive conservation funding and implementation at a scale that matters. For these reasons, the IWJV utilizes an approach in which multiple natural resource benefits and people are front and center in our thought process, planning, and implementation.

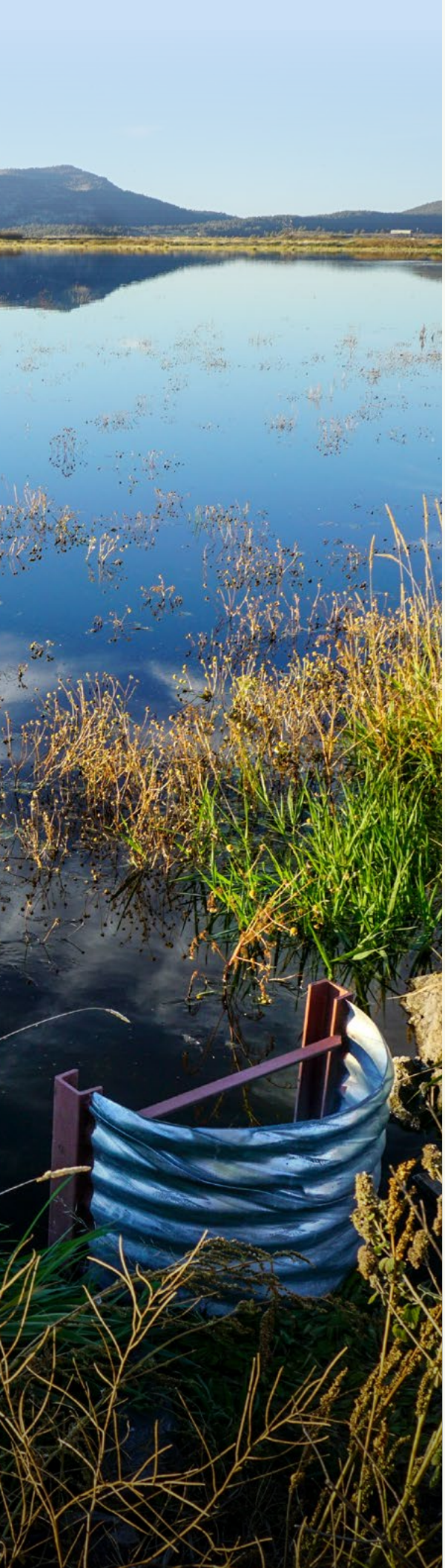
The Intermountain West includes most of North America's sagebrush ecosystem; an array of rivers, streams, and floodplains with productive wetlands; and a diversity of western forests. However, climate change and other stressors are leading to massive landscape change. This is seen when invasive annual grasses, encroaching conifers, and other threats result in the loss of 1.3 million acres of sagebrush habitat annually, wetlands are drying in space and time at an alarming clip, and western forests experience increasing catastrophic wildfires.

These challenges necessitate innovative and accelerated approaches to conservation delivery. We are in an era of significant conservation funding through the Farm Bill and other sources devoted to active management of rangelands, western forests, and irrigated lands. The IWJV is uniquely positioned to engage partners in conservation that can be implemented at the pace and scale of landscape threats.

IWJV Management Board & Strategic Plan

An executive-level management board governs the IWJV. This guiding body includes officials at the highest levels of western state and federal agencies, non-governmental organizations, Tribal partnerships, energy companies, and agricultural producers. This self-directed partnership is relentless in pursuing common ground that unites diverse perspectives.

The IWJV Management Board developed a strategic plan that guides our long-term work. The plan defines our "why" and provides a clear picture of our conservation philosophy and core values, who we are, and how we operate. One of its unifying principles is a deep commitment to working lands and the people who steward them. It also documents our support of land management practices that sustain bird habitat in a voluntary, nonregulatory manner. These pillars of the IWJV's work are grounded in science-based habitat conservation and our emphasis on collaboration, partnerships, and pragmatic conservation solutions.



Entrepreneurial Business Model

The IWJV helps partners deliver effective conservation by leveraging funding beyond the base U.S. Fish and Wildlife Service (USFWS) funding received through the joint venture line item in the annual Appropriations Bill.

For example, the IWJV FY 2024 budget included $1.1 million of base USFWS joint venture funding, but the total IWJV FY 2024 budget was $6.7 million. The Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), other programs of the USFWS, ConocoPhillips, and Rocky Mountain Power provided the remaining $5.6 million.

The IWJV core staff and 50-plus field delivery capacity partner positions supported with this funding trigger $40–50 million in on-the-ground conservation delivery investments annually through NRCS, BLM, and other funders. These project investments would likely not happen without the additional partnership capacity created through the IWJV.

Catalyzing tens of millions of dollars in federal conservation funding brings a high level of relevancy to the IWJV's work, which spurs interest in joining the IWJV Management Board among leaders in the West. This feedback loop results in the IWJV continually strengthening its operation with new funding sources, visionary board members, and innovative approaches. The IWJV Management Board has supported this business model for 17 years. The IWJV annual budget and the amount of conservation funding catalyzed will vary, but this approach will be the foundation of our work for the life of this plan.

PLAN APPROACH:

Why This Plan Matters

The IWJV partnership often must secure funding for on-the-ground habitat conservation from programs and sources in which wildlife habitat is not a primary objective. This reality requires emphasizing the multiple benefits of conservation practices; e.g., wildfire risk reduction, water quantity and quality improvement, soil health enhancement, and rural economy sustainability.

Birds and bird habitat needs seldom drive landscape-scale conservation in the Intermountain West, but there are many ways to incorporate migratory bird habitat conservation into programs with much broader natural resource objectives. For example, large federal funding packages often include very little specific focus on bird conservation but provide funding at levels in which millions of acres of key bird habitat can be proactively protected, restored, or enhanced per year.

These funds are driven by people's desires to improve ecosystem function toward greater resiliency; i.e., fewer catastrophic forest fires destroying communities, new ways of managing water resources sustainably, fewer rangeland fires that result in the type conversion of sagebrush to invasive annual grasses, better soil health, healthy rivers that support native fish, improved habitat connectivity for big game, and stronger rural economies that help keep working lands intact.

This plan lays out key concepts, approaches, and ideas for partners to strategically conserve wetlands/water, sagebrush, and western forests to provide habitat that supports bird populations to the greatest degree possible. This plan leans into *ways that partners can innovatively address* the daunting challenges of wetlands drying, degradation of sagebrush ecosystems, and loss of resiliency in western forests.

Looking to the Future

The Intermountain West is a region with incredibly intact and highly functional landscapes supporting some of North America's most impressive wildlife populations. Cutting-edge science tells us that these landscapes are functionally changing from threats—wetland drying, rangeland fires converting sagebrush habitat to invasive annual grasses, conifer encroachment in the sage, and heavy fuel loads in forested habitats—that are not prominently featured in the wildlife management textbooks of the past.

Today's challenges require innovation. The "Defend the Core, Grow the Core" sagebrush conservation strategy is a good example of the innovation the IWJV immediately incorporated into our operations. Likewise, our wetland habitat modeling—depicting surface water in space and time—has driven new approaches to conserving wetland habitat. We can't predict when these scientific breakthroughs will occur, but this much is clear: new approaches can and will be developed each year that improve the IWJV's ability to sustain and improve key habitats. To stay relevant, we need to be able to vet new information and incorporate it efficiently.

The IWJV Staff, Management Board, and Partnership recognize the need for adaptability in our operations and will treat this plan as a "living, breathing" document. We refine our operations through an annual operational plan that describes the coming year's specific work and serves as the IWJV's annual budget justification. This implementation plan will live in the space between our "evergreen" strategic plan and each year's Annual Operational Plan. We will update and refine this plan with new information and conservation advancements. This approach will support our partners who are working in an era of dynamic landscape change, meeting a growing need for real-time innovation in conservation.

Partnerships

CHAPTER ONE:

People & Partnerships Are the Foundation

Humans play a critical role in habitat sustainability. We are embedded within landscapes and are dependent on healthy ecosystem elements—air, soil, water, plants, and animals—and the functions they provide. We cannot separate humans from the environment, yet we often try. Local and traditional knowledge, science, planning, communications, relationships, and passion for the work the IWJV does must all be applied through a lens of relevance to people: human interactions intertwined with the landscape.

The IWJV's existence is based on recognizing the importance of people and partnerships. The people who comprise our partnership have grown into a vast network across the western landscape and the broader United States. Our partners approach landscape health differently depending on their roles and motivations on the landscape, but the end goals are similar: a healthy system that provides for all.

The IWJV prioritizes an approach that integrates people and landscape. A challenge that can traditionally affect habitat efforts is that lines are drawn across cultural, disciplinary, and institutional divisions. Efforts are siloed for numerous reasons, such as agency and program structures, thus creating arbitrary and inconsistent methods of tracking progress and marking successes. These metrics often lack the nuance to capture ecological, socioeconomic, and institutional complexities and, thus, the true impacts on habitat within a system[1].

Our understanding of landscape and ecological, socioeconomic, and institutional systems in which our work is placed continues to evolve. Our thinking and approach to habitat conservation explores the complex nature of these systems. Our collaborative, integrative, place-based approach allows us to sustain habitat for multiple purposes and benefit ecosystems and their human and non-human inhabitants.

[1] Who gets harmed as the Colorado River changes?

Many Forms of Knowledge

IWJV supports empowering partners in place-based decision-making that is informed by a suite of knowledge types (Box 1) to inform conservation. Many types of knowledge generated through different processes are valid and robust, including Indigenous Knowledge, local knowledge, and western science. One way of knowing is not inherently better than another, and there are temporal, spatial, and topical strengths and gaps in all forms of knowing. We believe that using a wide variety of sources of knowledge and expertise can improve conservation efforts and facilitate participation and ownership from many different people and perspectives.

Broadening knowledge sources expands the scope of information and values that can inform actions on the ground[2]. Indigenous Knowledge provides information related to species, places, and processes important to Tribes and relevant to the function of ecological systems[3,4]. In many fields, the temporal scale of Indigenous Knowledge greatly exceeds that of western science, which is generally limited to the last century. Additionally, Indigenous Knowledge provides a framework for incorporating human values into ecological problem-solving, as ecological knowledge is inseparable from culture, language, and survival[5]. In addition to Indigenous Knowledge, local knowledge and expertise held by people such as farmers, ranchers, natural resource specialists, and hunters, who have long histories of living in, working on, or using the lands, can provide place-based knowledge.

It is imperative to acknowledge that appropriate engagement with Indigenous Knowledge differs from engagement with western science. Indigenous Knowledge must be used with permission in relationship with Indigenous Peoples through a process that is participatory and inclusive, not extractive and appropriative. Mutually beneficial partnerships that are centered in place, respect Tribal and Indigenous sovereignty and land rights, protect Indigenous Knowledge and Indigenous People, and acknowledge historical context and injustice are one model for integrating Indigenous Knowledge with decision-making[6].

Engaging with Indigenous Knowledge has the potential to bring new voices and perspectives to conservation and address past inequities, but this work must be intentional to prevent harm to Indigenous People and loss of Indigenous Knowledge[7].

To be successful, we must understand and integrate the many forms of knowledge and the role of people in establishing our habitat priorities. This requires a holistic approach that lends itself to sustainable outcomes for those who are part of the landscape: past, present, and future.

[2] Wall-Kimmerer 2002

[3] Wall-Kimmerer 2002, Lake et al. 2017, Long et al. 2023

[4] Hessami et al. 2021

[5] Wall-Kimmerer 2002

[6] Kūlana Noiʻi Working Group 2021, Council on Environmental Quality 2022

[7] First Archivist Circle 2007, Council on Environmental Quality 2022

BOX 1

Key Definitions for Knowledge Types Addressed in This Chapter

Indigenous Knowledge

We use the definition of Indigenous Knowledge developed by the Council on Environmental Quality for their Guidance for Federal Departments and Agencies on Indigenous Knowledge:

Indigenous Knowledge is a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by Tribes and Indigenous Peoples through interaction and experience with the environment. It is applied to phenomena across biological, physical, social, cultural, and spiritual systems. Indigenous Knowledge can be developed over millennia, continues to develop, and includes understanding based on evidence acquired through direct contact with the environment and long-term experiences, as well as extensive observations, lessons, and skills passed from generation to generation (Council on Environmental Quality 2022).

Indigenous Knowledge is also referred to as Traditional Knowledge, Traditional Ecological Knowledge, Indigenous Traditional Knowledge, Native Science, and by other terms. We use Indigenous Knowledge throughout.

Local Knowledge

People who have long histories of living on, using, or working in a landscape and interacting with the natural world. We use the Food and Agricultural Organization's definition of local knowledge:

Local knowledge is the knowledge that people in a given community have developed over time, and continue to develop. It is: Based on experience, often tested over centuries of use, adapted to the local culture and environment, embedded in community practices, institutions, relationships and rituals, held by individuals or communities, dynamic and changing

Western Science

We use the definition of western science from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services:

Western science is… knowledge typically generated in universities, research institutions and private firms following paradigms and methods typically associated with the "scientific method" consolidated in Post-Renaissance Europe on the basis of wider and more ancient roots. It is typically transmitted through scientific journals and scholarly books. Some of its central tenets are observer independence, replicable findings, systematic skepticism, and transparent research methodologies with standard units and categories (IPBES).

Foundational Partnership Structures

The foundation of the IWJV is a strong and diverse network of people. Our partnership process supports collaborating to balance diverse human interests, functional habitat, and the conservation and management of wildlife. We strive to be relevant by creating forums to bring people together and building a shared vision for conservation by:

- **Supporting partnership-driven conservation** through collaboratives that bring different perspectives together to achieve informed, landscape-scale conservation.
- **Investing in capacity building** through partnerships with established trust and credibility.
- **Engaging agricultural producers** as foundational implementers in conserving valuable working lands that support climate resilience, provide habitat for fish and wildlife, deliver an array of ecosystem services, and support rural economies.
- **Focusing on solutions with multiple benefits** through a broad set of conservation tools.
- **Strengthening voluntary, partnership-driven conservation programs** via the increased capacity to deliver funding, matching significant interest from other agencies and partners in working lands conservation.
- **Ensuring federal funding reaches local communities** and allows local people to develop innovative solutions for voluntary, proactive conservation at scale.
- **Building partnerships with research and management communities** to bridge the gap between science and implementation.
- **Working with programs and initiatives to help partners apply science, amplify communications, and leverage funding** to achieve what none of us could do alone.
- **Working to expand into new partnerships** that bring additional knowledge to inform decision-making.

Looking Ahead

Our work is based on viewing people as part of the landscape and recognizing that we mean all people on the landscape. Inspiring people to care about the rural landscapes of the West is one of the biggest challenges to the future of conservation. If enough people lose connection and interest, the conservation community will lose the resources and support needed to conserve the landscapes we work in. Thus, our work must be relevant to a broader suite of the American public than wildlife and other natural resource professionals. We must partner with and hire from a wide network, expanding beyond the voices and faces traditionally included in Western wildlife habitat conservation. We will bring different perspectives, cultures, and life experiences together to learn from each other. Our work must speak to the people who may never see an antelope run through the sagebrush sea, watch hundreds of migrating birds land on a flood-irrigated field, or rest beneath the shade of an ancient ponderosa pine. As a conservation community, we must ensure that people from across the United States value sustaining ecosystems, species, and long-held ways of life into the future.

As we move forward, we will:

- **Acknowledge** the interconnectedness of systems and people within the landscape. We will evaluate how partnership efforts can lead to beneficial long-term outcomes and identify meaningful ways to share our impacts. This will include identifying new partners and sources for collaborative work.
- **Lead** outreach efforts that invite and reflect different voices both internally and public-facing. This type of communication work is everyone's responsibility and requires developing relationships that intentionally include perspectives – indigenous people, multi-generational ranch families – not traditionally given a large platform in the business of wildlife conservation.
- **Engage** with people outside the habitats we work in who greatly influence decisions that impact these lands (e.g., urban populations, legislators, policymakers, etc.). Work with these folks to develop strategies to share the importance of habitats of significance and why these should matter to people who don't live or recreate in them. Incorporate new values these groups have for the landscapes into our work.
- **Sustain** and grow a diverse and impactful IWJV Management Board by continually challenging ourselves to identify and seek out individuals who share our core values while bringing different perspectives and potentially representing new entities on the board, helping us look to the future.

CHAPTER TWO:

Government Relations

The IWJV's Government Relations Efforts are Rooted in Relationships & Collaboration

Building relationships with congressional and agency decision-makers in Washington, D.C., is a long-standing core function of the IWJV and its Government Relations Committee. For three decades, the IWJV Management Board and Government Relations Committee have included members with deep relationships at high government levels and on Capitol Hill.

These potent individual relationships are bolstered by the committee's collaborative spirit in solving significant conservation challenges. The IWJV's conservation model is inherently bipartisan, and the people of our committee share that message, building an amazing level of trust and respect with one another and with decision-makers.

The primary goal of the IWJV's government relations work is to maximize the availability and impact of conservation funding in the West in alignment with the IWJV's priority habitats and mission. In addition, through the IWJV's ever-expanding partnership network, we work to help our partners access and implement conservation funding.

Base-level funding for Joint Ventures is provided in annual appropriations for the USFWS Migratory Bird Joint Venture program (Department of Interior Budget - USFWS – North American Waterfowl Management Plan - line 1234). Thus, maintaining (and increasing) the appropriated amount has been a focus of Joint Ventures—in conjunction with the Association of Joint Venture Management Boards—since their inception in the late 1980s. The base funding has seen nominal annual increases. For the IWJV to support conservation at a large scale, we must look to other funding sources and help champion bipartisan support for funding and policies that enable impactful, large-scale conservation.

Conservation Funding

In addition to the base funding provided to Joint Ventures through the USFWS, several other funding sources provide opportunities for conservation implementation aligned with IWJV priorities for wetlands/water, sagebrush, and western forests. These include the BLM Wildlife Conservation and BLM Fire & Fuels Programs, Farm Bill Conservation Title, USFWS Partners for Fish and Wildlife Program, North American Wetlands Conservation Act, and most recently, funding allocated to the USFWS, BLM, and NRCS through the Inflation Reduction Act and Bipartisan Infrastructure Law.

Conservation Implementation

Through intra- and interagency agreements with federal agencies such as USFWS, BLM, and NRCS, the IWJV applies its conservation model of field delivery capacity, communications, science to implementation, and partnership development to help ensure efficient and effective implementation of available funding for on-the-ground work. offers suggestions for improving programs or processes to better facilitate on-the-ground results, provides examples and ideas for conservation implementation, brings science-to-implementation support to prioritize strategic conservation, and utilizes communications to highlight successful programs and efforts.

Strategies & Approach

The government relations strategy uses a multipronged approach carried out by staff, partners, and management board members. A key component to the successful strategy is a cohesive, concise, and consistent approach that builds relationships with decision-makers locally and in Washington, D.C., delivers messages about programs that work, offers suggestions for improving programs or processes to better facilitate on-the-ground results, provides examples and ideas for conservation implementation, brings science-to-implementation support to prioritize strategic conservation, and utilizes communications to highlight successful programs and efforts.

The IWJV will execute a robust government relations strategy over the life of this plan that involves the following approaches:

Ensure a consistent D.C. presence via:

- An annual fly-in to Washington, D.C.
- Additional D.C. fly-ins where possible (topic-specific and/or in collaboration with other partners).
- A D.C.-based management board member to carry IWJV messages regularly and highlight critical issues and solutions from the western U.S.
- Engagement by D.C.-based policy staffers of management board member organizations on the Government Relations Committee, bringing real-time insights that help the committee develop and execute tactical strategies.

Cultivate D.C. relationships through events and other opportunities in the West, such as:

- Strategic relationship engagement throughout the year (by staff, management board members, partners, etc.).
- Participating in partner events in the Intermountain West that host D.C. congressional members and staff.
- Joining/supporting partners on congressional field tours.
- Joining/supporting partners on agency leadership field tours.
- Inviting congressional and agency leadership to IWJV Management Board meetings and field tours.
- Using IWJV communications messaging to highlight local projects to respective legislatures.

Drive funding to strategic conservation delivery by:

- Using the IWJV's unique relationships and structure to connect federal funding to on-the-ground conservation implementation.
- Utilizing intra-/interagency agreements and other funding tools to build capacity and offer science to implementation and strategic communications that support key federal agencies (BLM, NRCS) in conservation implementation.
- Leveraging private partnerships to further federal funding (seeking opportunities for private funding investments).
- Helping federal agencies build on-the-ground capacity for mutually beneficial outcomes.
- Demonstrating the success of existing efforts to federal decision-makers by highlighting local impacts/benefits, collaborative efforts that benefit economies and conservation, projects that offer nonregulatory solutions, and approaches that bring people with diverse perspectives together for conservation outcomes.

Looking Ahead

The IWJV government relations effort will maintain and grow strong relationships with leadership at federal agencies (BLM, NRCS, USFWS, etc.), the departmental level (U.S. Department of Agriculture (USDA), Department of Interior), Office of Management and Budget, and with congressional members and staff. Notably, we will prioritize relationships with NRCS State Conservationists in the West—the agency's key decision-makers—and leaders at multiple levels of BLM and USFWS.

We will explore opportunities for a greater voice to support conservation in the West, leaning on and growing the trust and credibility built over the last 30 years. We will bring pragmatic ideas, innovations, and solutions forged on the common ground of our partnership's diverse perspectives.

The continued success of the IWJV's government relations effort is a function of an incredible contribution by all involved who devote time, energy, relationships, and connections to the endeavor. Each year, the IWJV builds on the momentum from the year prior to carry relationships and engagement forward—utilizing our partners and forums in the West that include representation with congressional and high-level decision-makers. In addition, the IWJV continually innovates the messages, messengers, and approaches to D.C. relationships to ensure we maintain relevancy and build off previous efforts.

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CHAPTER THREE:

Communications

Communications as a Core Value & Function of the IWJV

With an increasingly diverse and growing partnership that has a stake in our actions, it is imperative that IWJV communications connect, inform, and support an intricate spectrum of people to catalyze strategic habitat conservation. The task is daunting: identify audiences, craft resonating messages, and implement tools and tactics to efficiently reach intended audiences across a vast region. Communications must also integrate continuous technological advances and compete for people's attention.

The IWJV can approach communications differently than any of our partners due to the unique nature of our organization. We are not bound to public engagement structures to which federal and state agencies must adhere. Nor do we need to produce communications to raise funding from a membership base like non-governmental organizations. Our flexibility to explore different avenues of engagement with strategic creativity and innovation are invaluable. This unique position empowers us to implement a communications model incorporating multimedia storytelling about partnership-driven conservation efforts and the people who make them happen.

Communications Philosophy

Our communications advance the understanding of conservation programs, science, and tools as well as make connections so our partners can more effectively implement on-the-ground work.

Communications Objectives

With this philosophy in mind, our communications objectives are to:

1. Increase awareness about important wildlife habitat, especially in the face of climate change;
2. Engage a diversity of partners in strategic conservation with a shared vision to restore and manage habitat;
3. Connect our audiences to IWJV- and partner-produced science by appealing to values and strategically translating technical information;
4. Showcase proven models, outcomes, and other conservation-oriented innovations—especially those using partner funding resources—that benefit birds, other wildlife, and local economies; and
5. Communicate the importance of community-led conservation of wetland, sagebrush, and forest ecosystems across the West.

In-house Tools & Tactics

Strategic Communications Plans

The communications products described below require detailed and dynamic strategic plans.

Complex, Long-term Project Planning: Some of our projects require communications plans because they involve numerous partners to develop and translate complex bodies of science and result in multiple outreach products. These include web pages, fact sheets, infographics, feature articles, videos, and media engagement. Projects can take months or even years to complete. Long-term project plans document background information, identify purpose/outcome/objectives, develop messages and timelines for production, strategize distribution, include FAQs, and more.

Proposals Requiring Funding Beyond Staff Time: Some large projects require budgets that allocate funding to contractors or outside businesses beyond staff salaried time. When federal funding is used, this can trigger the need to fly a competitive Request for Proposals to work with contractors beyond $10,000. The proposal system also invites funding partners to review the planning activities of a product and approve it for implementation. Films are one example of projects that need proposals.

Distribution Plans: These plans identify the platforms both the IWJV's and partners' and people we intend to seek out for content distribution, as well as the timeline for publication on each respective platform. These are identified based on the audiences we hope to reach, the action requested, and the nature of the content.

Digital Products & Platforms

Digital tools and platforms allow the IWJV to be efficient and effective with its messaging. Additionally, partnership engagement is bolstered by digital tools that facilitate two-way communication. Direct interaction from our audiences, including anecdotal data on how communications have facilitated valuable conservation connections, is incredibly valuable.

Websites: The IWJV's websites are the hub for our digital presence. They act as the "storefront" of our organization, inviting potential partners in to learn more about us or existing partners to find the content they seek. Our other communications tools point back to our website to house public-facing products. The IWJV's newsletters, videos, and social media accounts drive website visitation.

eNewsletter: The IWJV's monthly eNewsletters allow us to send information directly to our partners' inboxes. All other forms of communication require the viewer to take action and come to us for information. With an audience of over 5,000 subscribers and high open rates for our industry (25–35 percent on average), our eNewsletters allow us to effectively share three to six pieces of our highest-quality, original communications content with a broad audience each month.

Social Media: The IWJV uses Facebook, Instagram, YouTube, and LinkedIn to share content engagingly and collaboratively. Our social media platforms allow us to broadcast our activities and support our partners in distributing content. This is a key way we connect with new demographics. In that social media is constantly changing, with platforms that frequently grow and decline, a large amount of staff research goes into understanding how best to use these tools. We regularly analyze the value of our time and impact on social media.

Communications Events

Some of the IWJV's most powerful tools are communications-led and -focused events. These gatherings bring a select group to a location (in-person or virtual) where they directly engage with IWJV partners and staff. This allows for the impactful delivery of our conservation messaging. The following communications tools are increasingly in-demand services.

Journalist Workshops: The IWJV is practicing an effective model to reach mainstream audiences with our messaging via mass media journalism through our workshops for journalists. These multi-day field tours connect mass communications professionals to the places and people we want to highlight. Without these events, journalists would have difficulty connecting to these information sources. See an example of a journalist workshop we held in the Bear River Watershed and the stories it generated here.

Networking with Other Communications Professionals: The IWJV recognizes that we often communicate within a silo of like-minded conservationists. We believe that collaborating and connecting with communications professionals from other organizations helps build awareness and support for our messaging outside of this silo. We do this most frequently by coordinating with communications staff at other relevant organizations to create and distribute collaborative content. Furthermore, our Storyteller's Circle helps connect conservation communications professionals in bi-monthly, craft-focused workshops and associated events.

Virtual and In-person Trainings: A vital component of the IWJV's conservation implementation is communicating specialized knowledge and information across organizations. We therefore prioritize supporting educational workshops both online and in-person to maximize the strengths of both learning environments. One example is the 2023 virtual low-tech restoration workshop—which will remain free online for public access—followed by the facilitation of and storytelling about an in-the-field work day later that year.

Evaluation

Evaluation allows us to determine whether communication intentions are met and will enable us to adapt future communications for greater effectiveness. We develop evaluation metrics in concert with the tactics and tools we use. Throughout the history of the IWJV's communication program, it has been a challenge to evaluate our content's conservation impact. As we evolve and our communications become increasingly sophisticated, we will seek new ways to quantitatively and qualitatively calculate our impact. This includes studying the best practices in the industry while staying up-to-date with the IWJV's conservation goals. Our current tools for evaluation include:

Digital Tools Evaluation Report: This report tracks evaluation metrics resulting from the delivery of digital communications tools. Each report focuses on the previous fiscal year and on trends over earlier years, and analyzes the results of targeted campaigns and releases. We also conduct analyses to answer key questions and improve our digital communications efforts (e.g., determining the characteristics of our most-viewed eNewsletter articles in past years).

Google and Other Built-in Analytics: We track unique visits to web interfaces to understand engagement with content and tools on our websites. The numbers tracked by Google Analytics help inform how we understand a piece of content's success (or "reach") and can help us identify ways to improve our distribution methods and engagement. Metrics such as time on a page and bounce rate help us understand user behavior.

Anecdotal, Qualitative Documentation: Although direct feedback from our audience is sporadic, it is the most helpful tool in judging our content's true impact. Hearing how our partners share and use our communications products—as well as how the products help them achieve their conservation goals—is valuable information for future communications planning and design. We document relevant anecdotal feedback as part of our year-end communications report by recording information staff receives and commentary our partners deliver and forward. This also illustrates how new partnerships can be established through communications.

Partner Engagement

Communication is key to functional, robust partnerships and thus is the heart of our work at the IWJV. Partnerships require nurturing to engage great people who represent multiple entities with diverse values and beliefs and are committed to working together toward a common conservation purpose for birds, other wildlife, and communities in the West.

Each member of our IWJV staff engages in daily partner communication activities, whether calling a long-time colleague about a large project, delivering carefully honed messages during Hill visits, or emailing a potential partner to introduce them to the IWJV for the first time. Interpersonal communication is perhaps the most potent form of outreach and engagement. IWJV ideas and messaging are best spread when individual staff members build relationships and connect with individuals and organizations. As it covers a large geography, the IWJV also depends on a digital presence, supported by in-person engagement, to stay connected with and inform our partnership. Through this presence, we:

Foster Co-produced Communications: Our partners have limited time and capacity for collaboration. Successful co-production in the past has involved, in some cases, the IWJV taking the lead on developing a product and consulting with partners at critical milestones and for final review. Partners are more willing to share content co-produced with the IWJV through their own communications channels if they advise its development and review the final product. This results in strengthened relationships, a greater reach to new and/or different (potentially larger) audiences, and successful team building on shared priorities.

Grow Our Reach: Partnerships blossom and sunset naturally. We must continually grow and adapt the reach of our content and meet new people and organizations to help us continue to engage partners.

Seek Continued Learning: To expand and strengthen our knowledge and connections, the IWJV Communications Team will use our annual Individual Development Plans to identify people and subject areas where we can grow our skills, seek continuing education, and build partner relationships. Other types of learning, such as workshops, conferences, and online courses, are also encouraged.

Scanning the Horizon

As we look to the future, the following topics are areas of work that the Communications Team will be invested in throughout the life of this implementation plan and beyond. This forward-thinking section includes information collected through scoping exercises with staff and partners.

Expanding Mindfully

The IWJV's communications program brings entities together around shared values. We are commonly referred to as the "connective tissue" among federal and state agencies, non-governmental organizations, private companies, and members of the agricultural industry. However, barriers exist to broadening our audience and achieving awareness of our existence and mission. In our scoping efforts, IWJV staff asked many partners about their perception of our identity as an internally facing partnership organization and how to balance this with external requests for wider-reaching communications. Our conflicting identities directly influence general recognition of our work and our ability to engage with many audiences. The IWJV needs to be humble and supportive from behind while letting partners be the face of the work and to be cautious with controversial topics to avoid damaging our reputations. At the same time, partners have asked us to reach new audiences via new outlets and to grow beyond our existing networks.

Greater awareness and reach may not directly equate to better conservation outcomes. There are risks that come with mass recognition. In a recent synthesis of cognitive research regarding the effectiveness of conservation communications messaging[1], researcher Anne Toomey presents that while wider reach is often seen as an optimal goal when it comes to audience and impact, entrenched social ideas and values often lead to the rejection of new information unless it's presented in ways that are strategic and targeted.

Continued on next page →

[1] Toomey 2023

With this in mind, simply working toward a larger and broader audience reach is not always an ideal tactic. The IWJV, our partners, and our common conservation priorities may be best served by being strategic with our communications outreach and delivery. The following actions will help us grow our reach in a strategic and targeted manner:

Nurture Existing Partnerships at All Levels: We often take for granted that agencies (both state and federal) and partners at nongovernmental organizations know who the IWJV is as an organization and how we work. This is not always the case, especially among partners working in middle management or in the field; these partners are also among our most valuable relationships in their abilities to both implement conservation and generate conservation communications. They are therefore an especially important audience for IWJV communications. To achieve increased recognition of our work and to advance our mission, we will:

- Continue to dedicate ourselves to reaching our existing audiences and partners, especially at different organizational levels, acknowledging that this may be more important than expanding recognition of our work among new audiences.
- Develop new mission awareness materials, such as "Who is the IWJV?"-style communications geared to both existing and new partners.
- Strengthen relationships with communications staff at partner organizations and with other entities by collaborating on projects and coordinating on content that serves common goals.

Strategically Seek New Partnerships: The IWJV fosters a network of partners that, together, facilitate on-the-ground work that couldn't otherwise happen. This concept is one we should consistently lean into with our communications and partnership efforts. It will strategically help us seek new partnerships to improve our access to new audiences and support our conservation mission. To achieve this, we will:

- Emphasize strategy over random action when establishing new communications partnerships. We can be more efficient with our time and resources by identifying specific goals for engaging an audience or seeking content placement in new outlets.
- Identify impactful communication partnership opportunities where conservation priorities align and there is mutual benefit.

Communications to Galvanize Action

Today, people experience an incredible amount of information overload. Attention results in engagement and influence in all forms; therefore, attention is a prized commodity. The IWJV uses our communications to seek the same outcomes as other information sources and constantly looks for new ways to be competitive.

Toomey's[2] findings also show that while it is often thought that increased access to high-quality information and increased scientific literacy will directly influence individual attitudes and behavior, this is not the case, based on how humans cognitively process novel information. Rather, people naturally seek to integrate new information into worldviews that are influenced by personal values and the needs and norms of social networks.

Because one of the core functions of IWJV communications is to transform science into action, we must consider how we can do so by appealing to the emotions and values of our various audiences. We work closely with the IWJV Science to Implementation Team to identify science-based gaps within our partnerships and determine how communications can help fill them through the following actions:

Tell Stories About People and Experiences: IWJV's quantitative analytics constantly point to the fact that communications products perform extremely well when they focus on people, either our own staff or individual partners. Stories with central characters and emotional resonance may stick with readers well beyond the closing of a web browser. To achieve this, we will:

- Produce articles, social media posts, and films that explore an individual's motivations and experiences in conservation. This includes first-person narratives that connect audiences to specific characters.
- Create communications that incorporate the motivations of central figures. We recognize these stories resonate well with audiences for cognitive reasons. The issues of resource management with which the IWJV works often have emotional significance within the communities we serve, so identifying the heart of our communications stories can guide production.
- When it comes to defining how the IWJV partnership operates, we will seek opportunities to connect our audiences with the faces of the IWJV partnership, whether it's a capacity position, a management board member, or IWJV staff.

Practice Continued Innovation: Communication is one of the fastest-changing fields in conservation. The arena is highly competitive, and audiences expect regular revolutions in media and platforms. The IWJV is well-poised to adapt and explore new innovations in apps, social media, and multimedia storytelling tools. However, a critical eye toward efficiency and strategy is necessary, as many potential technological advancements in education and outreach will not serve our conservation mission or be effective in reaching our audience(s). With this in mind, we will:

- Strategically increase video production with a mix of contractor assistance, use of staff cameras, and high-quality phone video. Video production is one of our most time-intensive endeavors, so we will remain highly selective with video-based projects in order to maintain a diverse communications portfolio.
- Research and experiment with new outlets, tools, and tactics to stay relevant and up-to-date with cutting-edge technologies and trends.
- Seek select opportunities to partner with other organizations to reach different audiences through platforms and mediums not currently within the scope of the IWJV's communications program.

[2] Toomey 2023

Communicating the Relationship Between Wildlife & Agriculture

Water, sagebrush, and forests provide important natural resources that sustain much of our country's agricultural industries. In many instances, healthy habitat and wildlife populations cannot be separated from working agricultural lands. As referenced in the partnership chapter of this implementation plan, healthy landscapes rely on Indigenous Knowledge, western science, and local knowledge to ensure durable conservation. Communicating the relationships between agriculture and wildlife is a long-practiced role of the IWJV and one we will continue to refine, grow, and improve upon.

Strategically Elevate the Role Agriculture Plays in Conservation:

Much like our approach to science communications, the IWJV works to inform and influence people to reach the end goal of land conservation by appealing to their emotions and values. By approaching this topic with interpersonal stories, harnessing the power of social networks and communities, and reflecting on the many ways of knowing that exist in our society, we can effectively relate the wildlife values provided by agriculture. With this in mind, the IWJV's communications will:

- Target specific organizations and audiences with information about working lands, to increase the conservation literacy of entities that may not currently understand or appreciate the value of agriculture to wildlife and water resources.
- Seek new forums to be thought leaders in the sustainability of agricultural lands that provide important habitat benefits. Elevate these values in ways that our partners individually cannot do.
- Profile agricultural producers stewarding important landscapes/habitat in order to connect urban audiences to rural communities and people.
- Communicate science that demonstrates how and where agricultural lands and practices are important for maintaining wildlife habitat.

Fulfilling Intra-agency & Partner Agreements

The IWJV has the great fortune of hosting a team of three communications professionals, partially funded through intra-agency agreements. These agreements acknowledge that communications are a key activity to which funding will be dedicated. The majority of that funding covers communications staff time and may also be used for contractor services. The IWJV Communications Team works to amplify the following actions:

Deliver Communications Services to Partners: We will coordinate with partners to provide communications support for projects and efforts that align with the IWJV's priorities. The delivery of these services will support the tenets documented in the agreements, memorandums of understanding, and other nonfederal partnership agreements. This includes coordination on one-off products, complex communications campaigns, and amplification of partner communications. It requires an important step of partners connecting IWJV communications staff with the appropriate people within their agencies or organizations (whether it is sources for stories or other outreach staff) to facilitate this work.

Elevate Our Impact to Attract Funding and Partnerships: Increasing the visibility of IWJV and partner work will require dedicated communications attention to further on-the-ground conservation. IWJV communications staff will leverage the results and reach of our tools and tactics to support our organization's partner-building efforts. The intent is that this work will result in impactful conservation along with continued and new funding streams.

Looking Ahead

These activities led by the communications staff at the IWJV are meant to encourage and empower the IWJV network— staff, board members, and partners—to think about their role in advancing communications. "Communication" is an active verb with many meanings and approaches. As leadership comes from all levels of an organization, so too does communication.

CHAPTER FOUR:

Science to Implementation

Science to Implementation as a Core Value & Function of the IWJV

The IWJV Science to Implementation Team supports our partners in bridging science and implementation to strengthen ecosystem restoration and management.

The Problem

The gap between science production and on-the-ground implementation is widely recognized as a persistent challenge to conservation and management communities.[1] Applied conservation science produces innovative science and cutting-edge datasets, maps, and tools to support the conservation and management of globally significant ecosystems. Adopting this ever-increasing body of science and technical information is challenging for resource managers. It often lags behind science production and sometimes does not happen at all. Too often, science production is treated as a top-down, linear process ending with peer-reviewed literature left for land managers to find.[2]

Scientists may take the additional step of conducting outreach and presentations to make managers aware of the research. Still, the burden of translating science into actionable steps has largely rested with practitioners, who may not fully understand or be able to access the information being delivered and who likely have a full list of other job priorities. This "loading dock" approach to science dissemination has proven inadequate for solving complex natural resource problems, especially because managers and practitioners face other barriers to using science beyond lack of information access.[3]

Many scientists do not have institutional incentive structures to support time-consuming co-production, which is a way of developing knowledge by engaging end users of science in the design and development of research.[4] Furthermore, the sheer volume of new science, technologies, and "decision-support" tools being developed exceeds the capacity of scientists and resource managers to engage in co-production, even when desired. Regardless of the approach taken, even the best translation of technical products does not readily lead to consumption and adoption by resource managers. Effective science communication alone does not equate to changes in behavior or practices, and there are many behavioral, cultural, and institutional barriers to adopting technical information.[5]

[1] Cook et al. 2013, Bea et al. 2019, Dubois et al. 2019
[2] Beier et al. 2017
[3] Cash et al. 2006, Walling and Vaneeckhaute 2020, Wardropper et al. 2021, Olsen et al. 2024
[4] Lemos et al. 2018, Naugle et al. 2020, Bandola-Gill et al. 2023
[5] Toomey 2023, Olsen et al. 2024

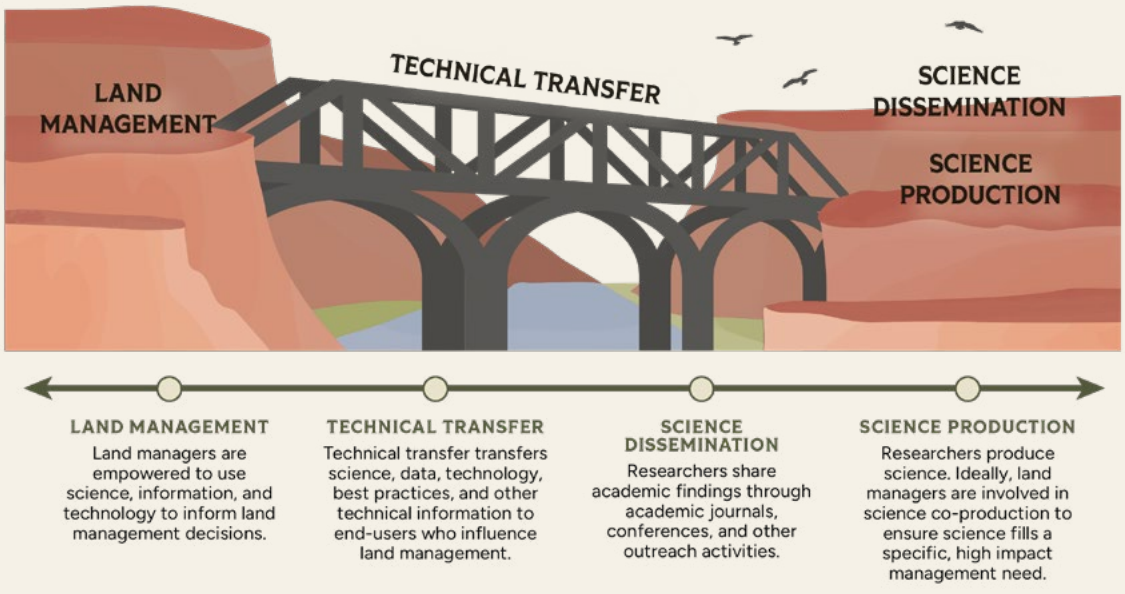
Technical Transfer as a Solution

Fortunately, there is a field of practice that overcomes these barriers. Technical transfer (i.e., science-to-implementation, cooperative extension, and science application, among other terms) is the process of transferring science, data, technology, best practices, and other technical information to end users who influence land management (Box 1)[6].When done successfully, technical transfer expands awareness and integration of this information and facilitates the adoption of best practices, strengthening on-the-ground management outcomes. Although often overlooked in traditional, top-down science delivery, technical transfer is an established concept with deep roots in American land grant universities and, in particular, agricultural extension.[7]

Boundary-spanning organizations like the IWJV legitimize technical transfer by bringing science producers, users, and facilitators together and providing capacity for their work.[8] The IWJV will serve as an organization for technical transfer by creating an environment where the convergence of perspectives and knowledge systems related to bird habitat management and conservation results in the transfer of information to land managers and other on-the-ground practitioners.

BOX 1

Bridging Science & Land Management Through Technical Transfer



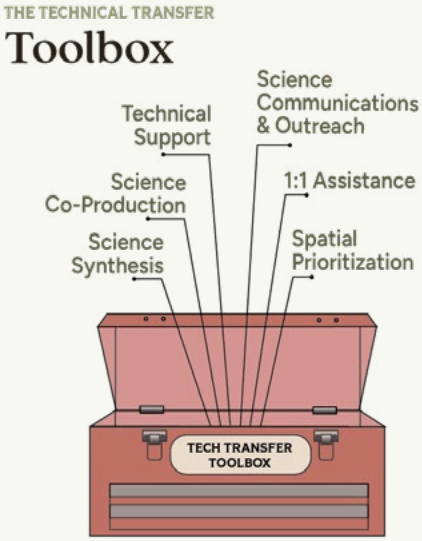
[6] Olsen et al. 2024, [7] Bahar and Griesbach 2020, [8] Kirchhoff et al. 2013, Beier et al. 2017, Olsen et al. 2024

Technical Transfer in Action

In practice, the Science to Implementation Team uses a toolbox of technical transfer tactics (Box 2). Efforts are tailored to the needs of end users, from using spatial data to prioritize management actions across the landscape to accessing the latest science to support a planning process. Examples of the IWJV's tech technical transfer work include:

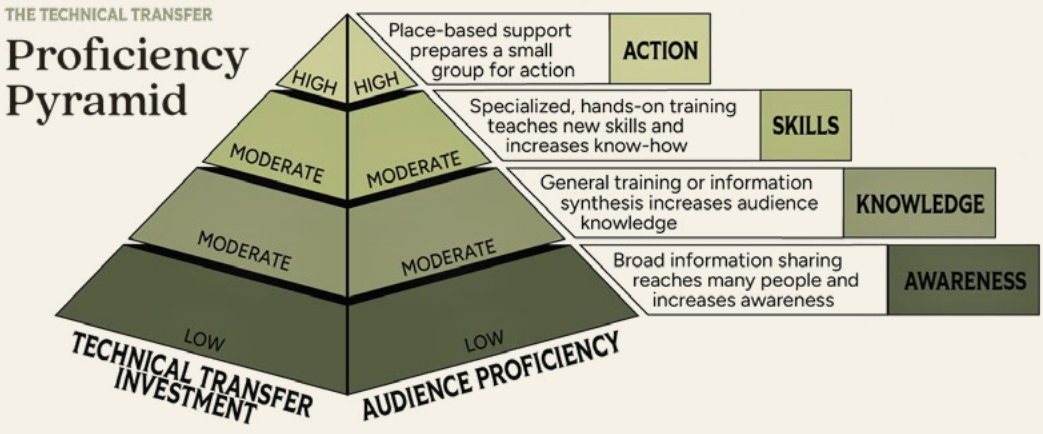
- One-on-one support, targeting conservation collaboratives in using spatial data in planning and users of the Wetland Evaluation Tool (WET).
- Reports on climate resilience in pinyon-juniper woodlands and carbon storage in rangelands.
- Virtual and in-person workshops to teach low-tech Zeedyk techniques.
- Development of spatial tools to incorporate bird values into forest management.
- A sortable, searchable list of top management-relevant resources.
- Technical support for the development of the USDA Climate Smart Agriculture and Forestry Mitigation Activities List.

The Technical Transfer Toolbox



The technical transfer toolbox describes some of the approaches used by the IWJV Science to Implementation Team.

BOX 2



The technical transfer proficiency pyramid describes the desired audience proficiency for a technical transfer effort and the corresponding effort (i.e., time, capacity, funding) needed to meet audience proficiency objectives.

Science Production

Despite the ever-increasing abundance of science related to birds and their habitats in the Intermountain West, knowledge gaps remain, hindering the efficacy of conservation and management in the habitats we work in. Our focus on science production emphasizes filling such gaps. Some examples include:

- **In wetland ecosystems**, the consequences of large-scale loss of wetland habitat due to the effects of climate change[9] on migratory waterbird space use and demography remain largely unknown.
- **In western forests**, basic information is lacking about the biology of the declining Pinyon Jay and how active management might benefit pinyon-juniper woodlands under a changing climate.
- **In sagebrush ecosystems,** knowledge is limited but growing on how simple structures made of sticks and stones, like Zeedyk practices, affect wildlife habitat.

The IWJV employs a co-production approach to science development to address these knowledge gaps and others. Co-production is an effective tool for engaging with partners and meeting their science needs. Through internal and external science production, the IWJV will remain a productive supporter of scientific advancement in the Intermountain West.

Internal Science Production

The IWJV contributes to a growing body of science used to inform conservation through in-house science production. Our primary science production niche has been understanding flyway-scale patterns in wetland habitat availability and dynamics and waterbird use of these habitats[10]. Leveraging remote sensing, cloud computing, and artificial intelligence technologies, the IWJV continues to innovate and advance our collective understanding of wetlands in the Intermountain West in ways not previously feasible. While the IWJV Science Team (the IWJV's Spatial Ecologist and Science to Implementation Team) has expertise and scientific credibility on a variety of habitats and species in the Intermountain West, we anticipate our primary internal science production focus will remain on addressing knowledge gaps related to flyway-scale perspectives of waterbirds and their habitats. Although all IWJV-led science has involved some co-production, opportunities exist to expand these efforts. For example, as the IWJV considers conservation strategies and science that support public wetland managers, increased engagement with these managers[11] will be necessary to ensure that IWJV science meets their needs and applies to their conservation and management objectives.

[9] Donnelly et al. 2020, [10] Current Science at the IWJV, [11]2025 IWJV Implementation Plan Wetland Ecosystems Chapter

Partner Science Production

In addition to in-house science production, the IWJV facilitates and supports additional science production through research partners. Given the diversity of habitats and research needs in the Intermountain West, there is a limit to how much science the IWJV can produce internally to meet these needs. As such, the IWJV has a history of "exporting" science production by supporting partners in filling key knowledge gaps through funding, technical transfer support, or communications. For example, the IWJV supported the development of several science products at the University of Montana with financial support from the BLM as part of the USDA NRCS Working Lands for Wildlife program[12]. This included the development of the Rangeland Analysis Platform[13] and the Landscape Explorer[14]. Thanks to the financial support and interest at Montana NRCS in assessing biological outcomes of their work, the IWJV facilitated the development of science and tools by Bird Conservancy of the Rockies to assess expected outcomes from forest management for western forest birds[15].

Leveraging this approach to developing science requires a network of science producers with appropriate expertise. The IWJV Science to Implementation Team and Spatial Ecologist maintain this network by participating in professional societies (e.g., Society for Range Management), tracking current research on relevant topics, and actively building partnerships with science producers.

Looking Ahead

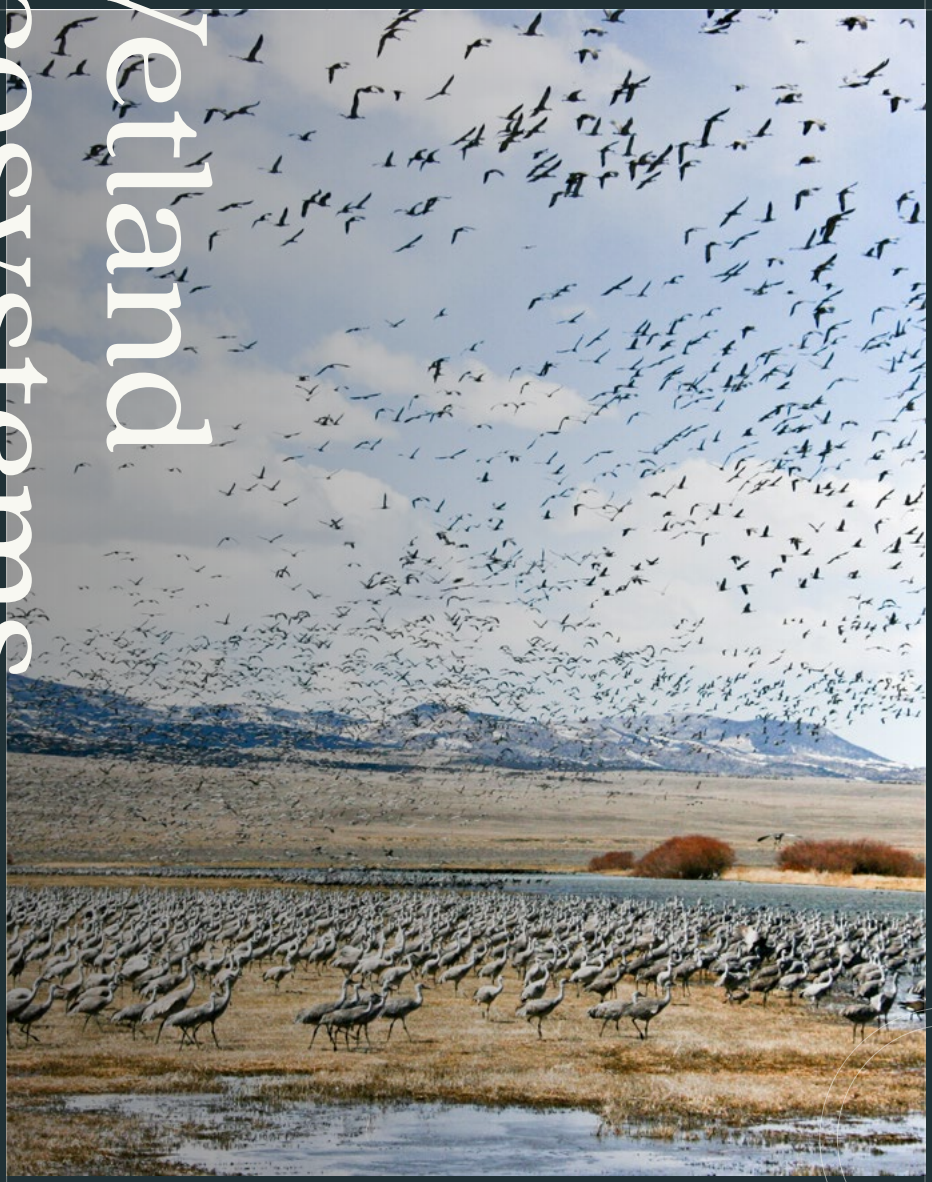
Given accelerating ecosystem change, high investment in ecosystem conservation and restoration, and the large body of knowledge, data, and tools available, bridging science and implementation is vital to durable conservation outcomes. Technical transfer can rapidly put existing and emerging information into action.

The IWJV Science to Implementation Team is well-positioned to bridge science and implementation gaps within our partnership and advance the developing practice of technical transfer using the technical transfer toolbox (Box 2).

[12] wlfw.org
[13] rangelands.app
[14] landscapeexplorer.org
[15] A previous example of this work from Colorado

CHAPTER FIVE:

Wetland Ecosystems



Introduction

The IWJV has focused on conserving wetlands since its inception. Wetlands are widely dispersed across the Intermountain West and characterized by high biological diversity and productivity, making them among the region's most important wildlife habitats[1]. Wetlands also provide many essential ecological and cultural benefits (Box 1)[2]. Given their limited distribution and support of critical ecosystem functions, wetlands in the region are inordinately valuable to wildlife and people.

Wetland systems in the Intermountain West have been highly modified and are at considerable risk of loss and degradation[3]. Furthermore, a new threat has emerged in recent years: decreases in water availability leading to sustained wetland drying (i.e., wetlands flood for shorter durations within and among years). Research by the IWJV and partners has shown significant wetland declines across snowmelt-driven watersheds in the West, with climate change and overallocation of water resources acting as the primary drivers of this loss[4]. Drought in the West is not a temporary, regional issue; it is a long-run, landscape-scale problem with implications for food security, human health and communities, the economy, and fish and wildlife populations.

Water is one of the West's most critical and high-stakes natural resource issues. To ensure the persistence of migratory bird habitat into the future, we need intact wetland landscapes and water to sustain the intermittent flooding that defines them. All states within the IWJV boundary use some version of the prior appropriation doctrine[5] to allocate water, which relies on the priority of initiation of use to determine the order in which water rights are served. This system is especially important when supplies are short. As such, sustaining wetland habitats in the future requires a strategic investment in people and partnerships that are interwoven into the land and water. For example, supporting wetland-dependent migratory birds necessitates working with agricultural water users who hold some of the region's most senior water rights, particularly by maintaining flood-irrigated grass hay production, which represents a substantial contribution to temporary and seasonal wetland habitat early in the growing season.

In addition, managed wetland complexes often fill a complementary niche by providing essential habitat such as semi-permanent wetlands. These wetland complexes complete the life cycle needs of many migratory bird species and may represent the only water resources remaining on the landscape during drier times of the year, making collaboration with the managers of these wetlands important.

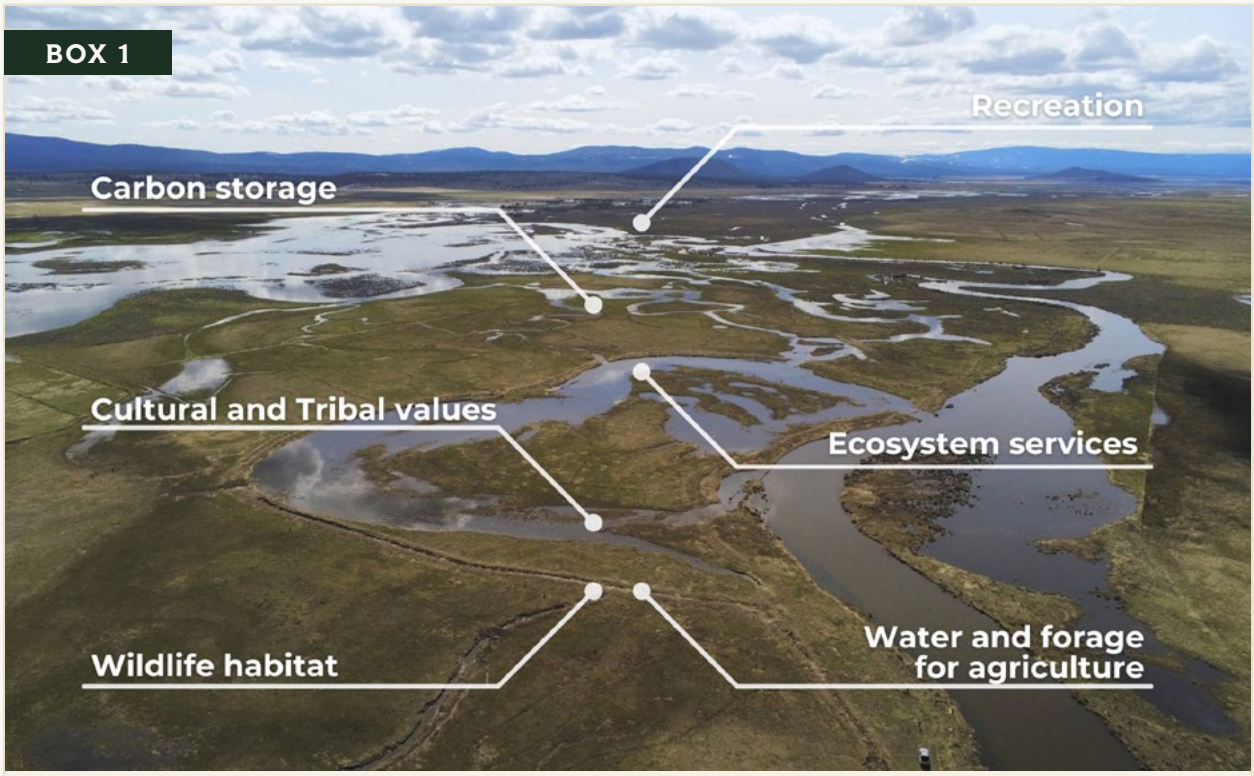
As a migratory bird joint venture established through the North American Waterfowl Management Plan (NAWMP) and tasked with coordinating cross-boundary habitat conservation, the IWJV plays a unique role in supporting wetlands across the Intermountain West.

Continued on next page →

[1] Donnelly and Vest 2012, [2] Ingram and Lewandowski 1999, Sketch et al. 2020, Conlisk et al. 2023, [3] e.g. Copeland et al. 2010, [4] Donnelly et al. 2020, [5] Waters and Spitzig 2018

Wetlands in this region provide essential resources for many populations of wetland-dependent birds (Box 2). However, these habitats lack a formal prioritization framework such as those developed for activities in the sagebrush biome. Although traditional habitat planning successfully provides measurable objectives for maintaining waterbird populations, these objectives are often established without considering ongoing environmental change. Rapid loss of flyway wetlands due to climate and land use change has raised concerns about the inability of the traditional approaches to effectively assess evolving environmental conditions and associated impacts on waterbird habitat. Recent NAWMP guidance suggests that joint ventures address these challenges by adopting an ecosystem approach to conservation design that uses landscape monitoring as an adaptive framework to inform habitat investments under changing flyway conditions.

The IWJV has taken a cue from recent sagebrush conservation prioritization frameworks by investing in wetland science that identifies emerging threats to long-term wetland resilience. In this chapter we leverage this new science to identify priority habitats and provide guidelines, concepts, and tools that will lead to meaningful conservation actions for western wetlands. Ultimately, this framework should be used to advance effective and collaborative wetlands conservation amid increasing water-related challenges.



Benefits Provided by Wetlands in The Intermountain West

Carbon Storage
In part due to their abundance, freshwater inland wetlands hold nearly tenfold more carbon than tidal saltwater sites in North America—making them an important contributor to regional carbon storage[1].

Cultural and Tribal Values
Indigenous peoples have had and still have relationships with wetland systems since time immemorial, and wetland plants and wildlife provide important food, medicine, and other cultural resources.

Wildlife Habitat
Wetlands are widely dispersed across the Intermountain West and characterized by high biological diversity and productivity, which make them among the region's most important wildlife habitats[2].

Recreation
Wetlands offer important outdoor recreational opportunities such as hunting, fishing, wildlife viewing, and nature photography, which are significant economic drivers for many western communities[3].

Ecosystem Services
Wetlands provide important ecological goods and services, including temporary storage of surface water (i.e., flood control and attenuation), aquifer recharge, streamflow maintenance, sediment retention, shoreline stabilization, and transformation of nutrients and pollutants[4].

Water and Forage for Agriculture
Wetland systems are critical to ranching economies in the western United States, providing water resources and high-productivity forage for livestock[5].

[1] Nahlik and Fennessy 2016, [2] Donnelly and Vest 2012, [3] Ingram and Lewandowski 1999, [4] Conlisk et al. 2023, [5] Sketch et al. 2020

BOX 2

Wetland-Dependent Bird Populations of Note in The Intermountain West

Percent of continental populations for wetland-dependent birds of note occurring in the Intermountain West by annual cycle

Guild	Species	Breeding	Migration	Winter
Waterfowl	Cinnamon Teal	>60%	-	-
	Northern Pintail	-	30%	-
	Tundra Swan *(Western)*	-	80%	-
	Trumpeter Swan *(Rocky Mountain)*	10%	-	>80%
	Greater White-fronted Geese *(Pacific Flyway, Tule)*	-	>50%	-
Shorebirds	American Avocet	56%	93%	-
	Black-necked Stilt	69%	-	-
	Snowy Plover *(Interior)*	75%	-	-
	Long-billed Curlew	57%	-	-
	Marbled Godwit	-	75%	-
	Wilson's Phalarope	-	50%	-
	Long/Short-billed Dowitchers	-	53%	-
Waterbirds	White-faced Ibis	73%	-	-
	California Gull	75%	-	-
	Eared Grebe		90%	
	American White Pelican	32%		
	Greater Sandhill Crane			
	Central Valley	42%	>90%	
	Lower Colorado River Valley	100%	>90%	
	Rocky Mountain	100%	100%	90%
	Lesser Sandhill Crane *(Pacific Flyway)*		>90%	

Adapted from Donnelly and Vest 2012

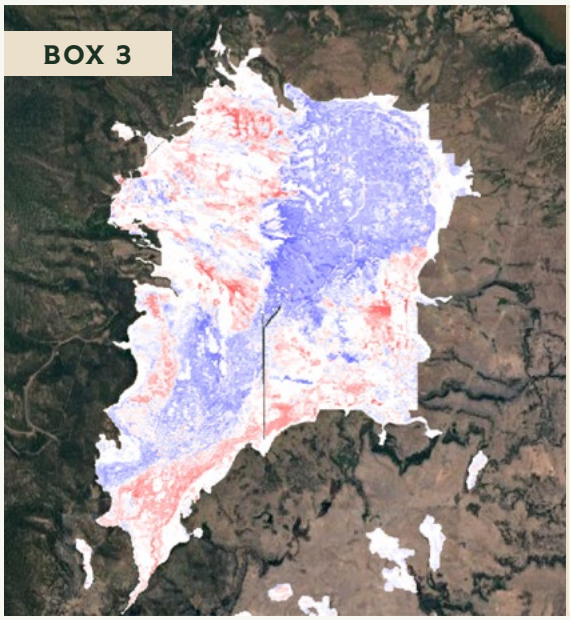
Tracking Wetland Change

The variable nature of water in the Intermountain West has created challenges for tracking wetlands due to wide fluctuations in surface water presence within and between years. A lack of accurate information about flooding over space and time has historically been a significant barrier to monitoring wetland trends and prioritizing conservation activities.

As a direct response to this information gap, the IWJV developed surface water models that comprehensively analyze surface water dynamics from 1984 to the present day. These models are packaged for users as the "Wetland Evaluation Tool," or WET[6] (Box 3). The tool encompasses the entirety of all 11 western states that the IWJV's region overlaps and can be used to analyze nearly four decades of landscape change in the wetland and flood-irrigated agricultural complexes that comprise the "green ribbons" of the West's intermountain valleys and floodplains.

Unlike traditional habitat objective-based planning, where progress is measured in isolation from evolving environmental conditions, this framework allows investments and outcomes to be evaluated through continuous landscape assessment that tracks the combined effects of conservation actions, climate, and land use change on surface water. This science provides a new lens through which the IWJV and our partners can better understand surface water dynamics and develop strategies for addressing wetland loss.

BOX 3



The Wetland Evaluation Tool

In 2023, the IWJV rolled out the full, 11-state **Wetland Evaluation Tool (WET)**. When paired with local knowledge, WET provides a powerful new way to track surface water and wetlands across our ever-changing landscape. Here, red shows wetlands that are trending dryer, while blue shows wetlands that are trending wetter.

[6] IWJV 2023

The IWJV's Water 4 Program

In 2016, the IWJV Management Board met to chart the future course of the IWJV's wetland habitat conservation efforts. The board identified a clear opportunity to modernize the IWJV's approach to wetlands conservation around themes of achieving multiple benefits and relevancy to people. This concept was developed concurrently with new wetland science and tools, and, in 2018, the IWJV Management Board took a bold step to catalyze accelerated wetland habitat conservation by developing the Water 4 Initiative. Now a fully fledged IWJV program, Water 4's goal is to conserve wetland habitat in the Intermountain West to sustain populations of migratory birds at continental goal levels through partnership-driven, science-based programs, projects, and collaborative efforts. This fresh approach centers on conserving wetland habitat and "water for" irrigated agriculture, wildlife and fisheries habitat, groundwater recharge, and landscape resiliency in ways that matter to people.

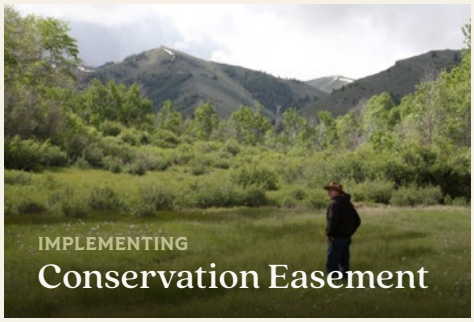
Water 4 supports a functional network of diverse wetlands across public and private boundaries by working with agricultural producers, land managers, and other partners. It yields expanded and accelerated results that benefit multiple stakeholders, deploying an approach that includes:

- Science that identifies vital working wetlands and enhances access to and use of science for strategic conservation, from field implementation to funding and decision-making.
- Capacity that addresses conservation bottlenecks and works through existing partnerships to increase the pace and scale of conservation. Adding capacity requires putting the right people with the right skills in the right place.
- Communications that advance conservation through stories about partnership-driven efforts, outcomes, and the tools that get the job done.

Examples of key practices that align with Water 4 goals and priorities are identified in the Water 4 Toolbox (Box 4). Water 4 uses science, communications, and capacity-building to support partners implementing these and other practices to advance multi-benefit wetland conservation efforts. The Water 4 program recognizes that people are an essential part of successful wetland habitat conservation. As such, the program focuses on functional wetland types that are grouped by both ecological characteristics and water management regimes. This approach connects threats to wetland habitats with opportunities to implement on-the-ground actions that support migratory birds under the existing framework of water management in the West.

BOX 4

The Water 4 Toolbox



Wetland Habitats of the Intermountain West

Much of the Intermountain West is characterized as North American Desert Biome (58 percent)[7], where low precipitation combined with high evaporation rates constrict the distribution of water resources. Although wetland abundance is relatively low here compared to other regions of North America, wetlands occur throughout the Intermountain West and primarily occupy areas of high hydrologic discharge within and adjacent to high-elevation mountainous regions. These systems are driven primarily by accumulated winter snowpack[8]. Snowmelt in mountain streams peaks from late spring to early summer, resulting in intermittent surface flows that feed many wetland basins. Stream discharge rates vary widely and are affected by seasonal, annual, and decadal shifts in precipitation. Additionally, high evaporative rates in many areas result in intermittent and ephemeral wetland patterns.

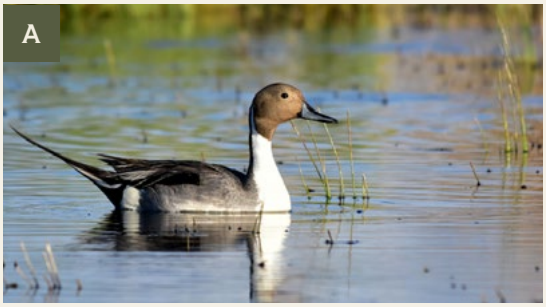
Combined, these characteristics sustain exceptionally dynamic wetland cycles that exhibit high annual temporal and spatial variability across regional scales. These wetlands are keystone habitats within the region because they help drive ecosystem form and function and structure biotic communities far beyond their areal extent. Over 80 percent of wildlife species common to the region depend partly on wetlands, including migratory waterbirds[9], which often rely on specific wetland types to meet annual life cycle needs (Box 5).

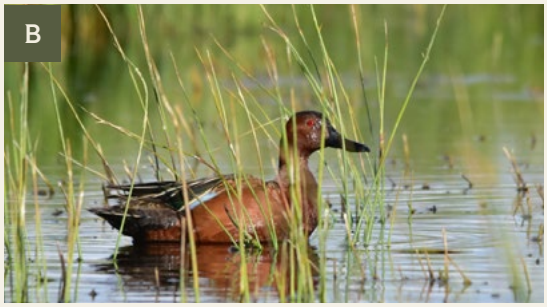
The variability of the region's wetland systems has given rise to an abundance of wetland diversity further structured by human water management (Box 6)[10].Three wetland habitats are identified as the primary focus of this plan due to their importance for migratory birds and the conservation opportunities offered by their connections to human water management. We further recognize other wetland types that provide essential habitat for migratory birds and represent additional opportunities for regional conservation efforts outside of this plan through the work and planning of other organizations. For more detailed descriptions of habitat types and functions, refer to the IWJV's 2013 Implementation Plan[11].

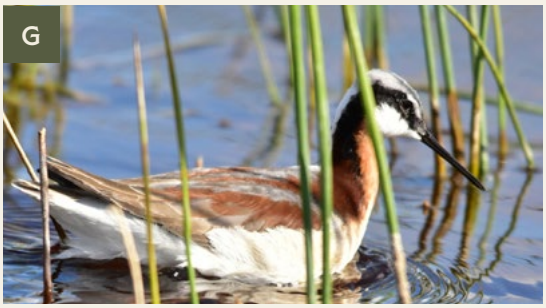
[7] CEC 1997, [8] Fyfe et al. 2017, [9] McKinstry 2004, [10] Downard and Endter-Wada 2013, [11] IWJV 2013

BOX 5

Wetland-Dependent Birds of the Intermountain West







Over 80% of wildlife species common to the Intermountain West depend on wetlands to meet some portion of their annual life cycle needs, including migratory wetland-dependent birds. The flagship species shown include waterfowl, shorebirds, and waterbirds that are emblematic of the wetlands of the Intermountain West.

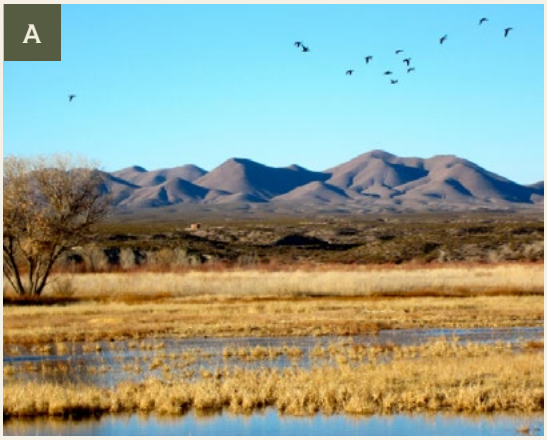
A) The Northern Pintail *(Anas acuta)* and **B) the Cinnamon Teal** *(Spatula cyanoptera)* rely on flood-irrigated agriculture and public wildlife management areas. **C) Greater Sandhill Cranes** *(Grus canadensis)* and **D) White-faced Ibis** *(Plegadis chihi)* frequent flood-irrigated agricultural areas. **E) The American Avocet** *(Recurvirostra americana)*, **F) Black-necked Stilt** *(Himantopus mexicanus)*, and **G) Wilson's Phalarope** *(Phalaropus tricolor)* rely on public wildlife areas and saline lakes, like the Great Salt Lake.

Photos: Tom Koerner/USFWS Mountain Prairie Region.

BOX 6

Wetlands of the Intermountain West

Wetland habitats in the Intermountain West provide outsized ecological benefits for their relatively small footprint on the landscape. The diverse geography of the Intermountain West, in combination with temporally dynamic water resources, creates tremendous wetland diversity.



A) Managed wetlands include many wetland types and provide a unique opportunity to adapt in the face of environmental change due to existing infrastructure and staffing dedicated to habitat stewardship. Many of these areas, such as the Bosque del Apache National Wildlife Refuge in New Mexico (pictured), were originally designated for the purpose of protecting habitat for migratory birds, especially waterfowl, and thus create a network system of protected wetland habitats that are used by birds as they migrate across the landscape.

B) Flood-irrigated agriculture, like this field in the Bear River Watershed of Utah, provides important seasonal habitat in historical riparian footprints. These areas support nearly 60 percent of temporary wetlands in the Intermountain West.

C) Riparian areas, like this stream outfitted with beaver dam analogues at Knott Ranch in Colorado, can provide important water resources for wildlife in otherwise dry landscapes.

D) Terminal saline likes, such as the Great Salt Lake, support enormous concentrations of birds during key stages of their life cycle, including breeding, migration, staging, and molting. Many lakes are experiencing drying, reducing important habitat for migratory birds

Managed Wetlands

The network of managed wetlands on national wildlife refuges, Tribal lands, state wildlife areas, private wetlands such as duck clubs, and parks and preserves sustain migratory bird populations during all stages of their annual life cycles. Although many of these areas are composed of multiple habitats (including grasslands and other upland habitats, riparian areas, playas, unmanaged freshwater wetlands, and managed wetlands), we focus on the managed wetlands within these complexes. The biotic setting within these wetlands may vary widely, but the opportunity created by management makes them unique in that they can be effectively conserved and enhanced through management actions.

An IWJV analysis of a subset of managed wetlands shows that national wildlife refuges and state wildlife areas support approximately 193,600 acres of flooded and managed wetland habitat. This limited area represents a significant conservation opportunity (Box 7). Further opportunity exists with privately managed wetlands, such as duck clubs, where conditions are targeted for specific waterfowl habitat needs.

BOX 7

Managed wetlands within state and federal wildlife areas in the Intermountain West

State	Acres
Washington	7,992
California	32,953
Utah	63,208
Nevada	*28,496*
Colorado	*8,554*
Oregon	17,035
Montana	749
Idaho	*23,627*
New Mexico	6,815
Wyoming	4,217
Totals	**193,646**

Results represent maximum mean annual wetland inundation extents from 2015 to 2023. Summaries exclude a) large unmanaged water bodies and unmanaged wetlands within state and federal wildlife areas, and b) managed wetlands outside of state and federal wildlife areas.

[12] Donnelly et al. 2024, [13] Sueltenfuss et al. 2013, Donnelly et al. 2024, [14] GAO 2019, [15] Ferencz and Tidwell 2022

Flood-Irrigated Grass Hay Agricultural Lands

Flood-irrigated grass hay agricultural fields and pastures provide essential seasonal habitat for many species of migratory birds, with flood irrigation tied to grass hay production supporting 58 percent of temporary wetlands in the Intermountain West[12]. These systems primarily occur within historical riparian habitats. Flood irrigation practices convey large volumes of water through systems of canals and ditches before being applied to fields as sheet flow to saturate soils, creating wetlands that are both directly and indirectly supported by irrigation water[13]. Flood-irrigated systems such as these are often considered "inefficient," meaning substantially more water is diverted for irrigation than is required to produce the grass hay crop[14]. Excess water not consumed through evapotranspiration may percolate back into soils as recharge to local groundwater tables or follow subsurface flow pathways that eventually return the water to the stream from which it was diverted[15].

BOX 8

Acreage of wetlands associated with flood-irrigated grass hay by state in the Intermountain West

State	Acres
Washington	20,428
California	29,019
Utah	46,756
Nevada	*51,609*
Colorado	*77,992*
Oregon	115,213
Montana	140,459
Idaho	*154,482*
Wyoming	182,197
Totals	**818,156**

Approximately 818,000 acres of wetland habitats associated with grass-hay production exist in the valleys and river corridors of the Intermountain West (Box 8). These wetlands are human-managed systems that support many species of dabbling ducks, shorebirds, and waterbirds during the breeding, migration, and winter seasons. For instance, 67–96 percent of habitat use by migrating greater sandhill cranes occurs on private lands, where many wetlands are associated with irrigated agriculture.

Terminal Saline Lakes & Associated Wetlands

The large, terminal (*endorheic*) saline lakes within the Intermountain West are renowned for their unique biographic features and significance to wetland-dependent birds. Although the number of saline lakes is small, these water bodies are vital links in continental flyways, with numerous sites designated as critically important to waterbird populations[16].

Depending on their salinity, these sites often provide an abundance of brine shrimp (*Artemia spp.*) and brine flies (*Ephydra spp.*), critical food resources for various waterbird species. Terminal saline lakes support enormous concentrations of birds during critical stages of their life cycle, including breeding, migration, staging, and molting[17].

[16] e.g., NAWMP 2012, [17] Haig et al. 2019

Other Wetland Habitats

Many other types of wetlands exist in the Intermountain West and may be of local, regional, or flyway-scale importance for migratory birds, depending on their location and habitat characteristics. These include:

Riparian areas:

Riparian areas in the Intermountain West vary widely, including diverse deciduous tree and shrub floodplain vegetation, open meadows, cobble bars, and stream banks. Tree- and shrub-lined rivers, streams, springs, and ponds provide nesting habitats for various species, and islands create predator-free breeding habitats for ground-nesting waterbirds. Sandbars and mudflats along rivers and streams also support breeding and migrating shorebirds[18].

Reservoirs and other impoundments:

The construction of dams and other water projects in the Intermountain West has created open-water habitats beneficial to breeding, migrating, wintering, and roosting waterbirds. Islands provide breeding habitats for colonial waterbirds, and smaller species like shorebirds use shallow impoundments and levees during breeding and migration seasons.

Playas and ephemeral wetlands:

Small ephemeral wetlands, playas, and salt flats abound and are typically shallow depressions lined with a salt or alkali crust, limiting vegetation growth along the shore. These depressions fill with water seasonally, intermittently, or temporarily, depending on the depth of the water table or the amount of precipitation. In wet years, ephemeral wetlands can support high numbers of shorebirds, but this is contrasted by dry years when water may not be present[19].

[18] IWJV 2013, [19] Oring et al. 2013

Threats to Wetland Habitats

Habitat Loss

Functional Habitat Loss: Wetland Drying

Science produced by the IWJV and partners has revealed dramatic declines in wetland flooding within snowmelt-driven watersheds of the Intermountain West. In endorheic basins, lake areas declined by approximately 27 percent and wetland flooding was reduced by 47 percent between the mid-1980s and 2018[20]. These declines are the result of functional habitat loss, where lakes and wetlands still physically exist but the water needed to support migratory birds, fisheries, and other wildlife dries up quicker and more often. This trend is driven primarily by rising evaporative demands due to increasing global temperatures, as well as increasing human water use. Changes suggest that a regional tipping point in the ecosystem water balance has been reached, where supplies are overdrawn more quickly than they can be replenished.

Wetland drying trends compound habitat loss by creating temporal mismatches between migratory bird movement chronology and wetland abundance. For example, in the Southern Oregon–Northeastern California (SONEC) region, significant wetland losses have been driven by landscape drying as semi-permanent wetlands transition into temporary and seasonally flooded habitats[21]. This shift means an important habitat niche—deeper, late-season water for molting and migrating waterbirds—also disappears.

Physical Habitat Loss: Land Use Conversion and Exurban Development

Although 70 percent of all land in the Intermountain West falls within federal, state, or Tribal trust, approximately 70 percent of emergent wetlands occur on private lands[22]. Expanding urban and exurban development causes physical wetland loss by increasing habitat fragmentation rates, altering hydrologic patterns, diminishing water table recharge rates, and reducing habitat suitability for many plant and animal communities, especially wetland-dependent birds[23]. Ongoing physical wetland loss means remaining habitats become increasingly important because they must sustain wildlife demands with a diminished footprint.

[20] Donnelly et al. 2020, [21] Donnelly et al. 2022, [22] Donnelly and Vest 2012, [23] Maestas et al. 2003, Downard 2010

Changing Water Management

Water supplies that support wetlands are directly impacted by water management policies and decision-making at multiple levels, from individual landowners to local, state, and national governments. In riparian corridors, changing agricultural water management, particularly conversion from flood irrigation practices to more water-efficient systems such as sprinkler irrigation, may result in direct losses of temporary wetlands and indirect losses of surrounding habitats like riparian corridors[24]. The large-scale adoption of more efficient irrigation practices can also increase consumptive use, reducing groundwater recharge and associated return flows in streams and rivers[25]. In areas where urbanization encroaches on existing agriculture, a decrease in agricultural land productivity can increase the risk of subdivisions that fragment open landscapes used by wildlife[26].

Habitat Degradation

Plant Community Succession and Invasive Species

Timing and duration of flooding and disturbance influence the density and abundance of plant species within a wetland community. In wetlands where disturbance has been dramatically reduced or removed entirely, plant community succession can result in decreased seed production, reduced vegetative diversity, and increased populations of invasive species[27]. All of these factors can decrease the suitability of wetland habitats for migratory birds, even when water is present.

Alteration of Historic Floodplain Hydrology

Hydrologic connections between riverine systems and surrounding riparian habitats are essential for maintaining the high natural water tables necessary for sustaining wetlands within floodplains. River-wetland corridors were once common across the western U.S., but anthropogenic activities like channelization, dam construction, river regulation, floodplain drainage, and artificial levees have greatly reduced their extent[28]. These actions restrict seasonal flooding into channelized reaches and can lower the water table, uncoupling surrounding wetlands from the hydrologic processes on which they depend.

Water Quality

Many major wetland complexes in the region are located at the terminus of snowpack-driven systems and are impacted by upstream human activities such as mining and agriculture[29]. These water sources can be relatively high in concentrations of salts, nutrients, sediment, or contaminants that accumulate in terminal basins. Poor water quality and wetland water supply reductions can further concentrate contaminants, impacting wildlife habitat and threatening human health.

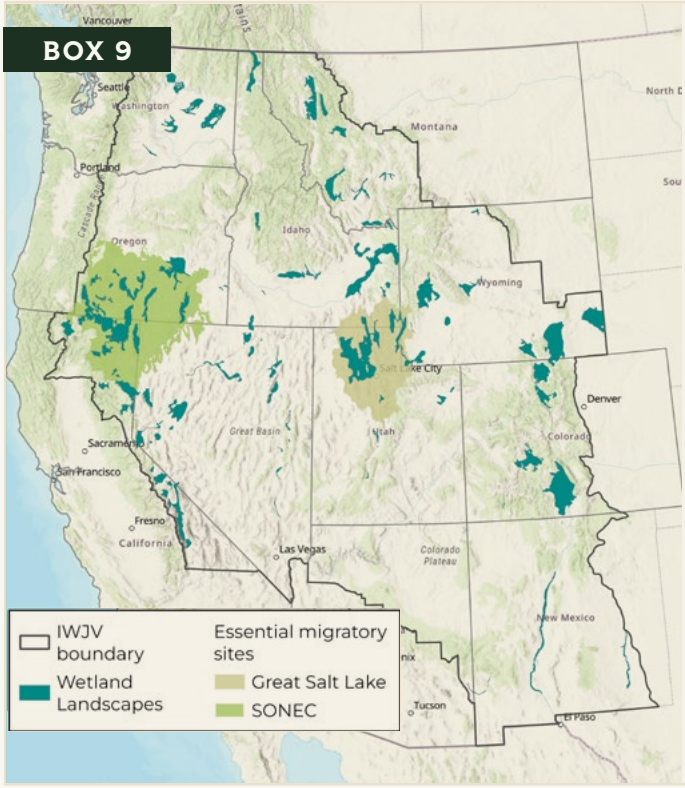
[24] Vanderhoof et al. 2019, [25] Ketchum et al. 2023, Morisette et al. 2023, [26] Dozier et al. 2017, [27] Gray et al. 2013, [28] Wohl et al. 2021, [29] US EPA 2000

Priority Geographies

In 2012, the IWJV published a series of science priority reports that summarized available knowledge of migratory bird habitat in the Intermountain West and identified key priorities for future science development[30]. A critical component of this effort was the establishment of the IWJV's 2013–2018 Wetland Focal Strategies, which delineated 18 wetland landscapes that encompassed approximately six percent of the Intermountain West but accounted for 50 percent of the inventoried emergent palustrine wetland systems in the region as identified by the National Wetlands Inventory. This effort also recognized challenges in mapping wetland availability, primarily in data extent and relevance to current conditions[31]. Science developed since 2012 by the IWJV and research partners across the West has filled many previously identified information gaps, thanks to wetland mapping products, expanded tracking efforts for waterbirds using new technologies, and research linking changes in water availability to migratory bird movement patterns. These focused scientific advances have dramatically expanded our understanding of wetland distributions and migratory bird ecology. The 2024 Focal Wetland Landscapes are updated to incorporate this new information (Box 9).

The IWJV identifies two levels of conservation opportunity within these landscapes: Essential Migratory Sites and Focal Wetland Landscapes. Collectively, these areas represent wetland habitats of significant importance for migratory birds in the Intermountain West. Strategic investments in these areas can maximize on-the-ground benefits for wetlands and flyway-scale conservation impacts. Further information detailing the significance of these landscapes to migratory birds is provided in the IWJV's Regional Wetland Profiles[32].

BOX 9



Focal Wetland Landscapes and Essential Migratory Sites of the Intermountain West

The 2024 IWJV Focal Wetland Landscapes represent wetlands that provide significant habitat for wetland-dependent birds in the Intermountain West. These priority areas reflect an updated version of the IWJV's 2012 Wetland Landscapes, incorporating new wetland and migratory bird science developed over the last decade.

[30] Donnelly and Vest 2012, [31] Donnelly and Vest 2012, [32] Anticipated completion in FY 2025

Essential Migratory Sites

Two regions identified in the 2024 Focal Wetland Landscapes are prioritized because they provide the highest value for multiple species of migratory birds at the flyway scale: The SONEC region and the Great Salt Lake. Both regions were acknowledged as "major migration hubs" within the IWJV's 2013 Implementation Plan[33]. These regions provide essential wetland habitats important for migratory birds, collectively representing approximately 25 percent of the inventoried wetland abundance in the Intermountain West[34]. They also provide crucial breeding and wintering habitats for many species.

Dramatic surface water declines have impacted both systems in recent years, with significant implications for migratory bird populations within the Central and Pacific Flyways[35]. Recognizing these challenges, the IWJV has engaged heavily in science to better illuminate the wetland dynamics of these regions[36], as well as the movement patterns of migratory birds such as cinnamon teal[37], white-faced ibis[38], and sandhill cranes[39]. Changing water availability will necessitate innovative solutions that meet the needs of both people and wildlife in these regions.

The SONEC Region

The SONEC region (Box 9) is continentally significant for North America's waterfowl, shorebird, and waterbird populations. Bird use of SONEC is closely linked with the Central Valley of California, where many species overwinter. Collectively, the two regions support habitat for over 60 percent of waterfowl in the western half of the continent[40]. They also provide essential breeding, wintering, and stopover habitats for a variety of shorebird and wading bird species[41]. In the spring, waterfowl use in SONEC occurs immediately before the breeding season and hence is particularly influential on population dynamics and reproductive success within the birds' annual life cycles.

Given the significance of SONEC wetlands during spring migration, the IWJV has developed specific spring migration population objectives that step down from the NAWMP to guide regional actions[42]. These objectives focus on dabbling ducks because species like Northern Pintail have continued to decline[43], even while goose populations have generally exceeded their population goals in recent years[44]. During spring migration, key habitats for dabbling ducks include managed wetlands in designated wildlife

Continued on next page →

[33] IWJV 2013, [34] Donnelly and Vest 2012, [35] Donnelly et al. 2020, [36] Donnelly et al. 2019, Donnelly et al. 2022, [37] Mackell et al. 2021, [38] Coons et al. 2021, [39] Donnelly et al. 2021, [40] Petrie et al. 2013, CVJV 2020, [41] American Bird Conservancy 2015, [42] Report: Spring Habitat and Population Objectives for Waterfowl in SONEC, [43] State of the Birds 2022, [44] Olson 2022

areas and private, flood-irrigated agricultural wetland habitats. Models assessing landscape capacity to sustain dabbling duck populations at goal levels indicate that it is essential to maintain a spring wetland habitat objective of no net loss. Opportunities may exist to improve habitat quality and waterfowl carrying capacity in some locations using the strategies outlined herein.

Wetland habitat availability in the SONEC region is changing rapidly. Recent assessments of shifts in wetland abundance show a loss of semi-permanent wetlands resulting from shortened hydroperiods caused by excessive drying. These drying trends have initiated a transition from semi-permanent to seasonal and temporary hydrologies. This process currently offsets concurrent seasonal and temporary wetland declines, a trend that is likely finite as the landscape continues to dry. Semi-permanent wetlands in SONEC act as a top-down indicator of wetland decline due to their position at the top end of the hydroperiod spectrum[45] (Box 8). These habitats provide crucial fall migration, molting, and over-wintering habitat for birds like diving ducks, coots, terns, and grebes, which need habitats provided by deeper water and longer hydroperiods. Detailed information about wetland habitats in the SONEC region is detailed in the IWJV's Regional Wetland Profiles[46].

BOX 10

Cascading Effects of Wetland Drying In Sonec & The Intermountain West

Functional wetland declines cause disproportionate impacts to waterbird species reliant on semi-permanent wetlands during all or portions of their annual life-cycle in the SONEC region. Semi-permanent losses from shortened hydroperiods caused by excessive drying force the transition of these habitats to seasonal and temporary hydologies—a process that offsets concurrent seasonal and temporary wetland declines[1].

[1] Donnelly et al. 2022

[45] Donnelly et al. 2022, [46] Anticipated completion in FY 2025

The Great Salt Lake Region

The Great Salt Lake (Box 9) is the largest saline lake in the Western Hemisphere. Although it receives only 15 inches of rainfall annually, it is surrounded by more than 470,000 acres of wetlands[47] that are supplemented by fresh water from the Jordan, Ogden, and Bear Rivers. In addition to the saline lake itself, surrounding habitats include marshes, mudflats, playas, and many managed wetland areas. Managed wetlands above and below the lake's annual meander line (excluding the lakebed itself) offer tremendous conservation opportunities contingent on the availability of continued water for flooding[48]. These wetlands are among the largest complexes in the western U.S. and are internationally recognized for their importance to wetland-dependent migratory birds[49].

The Great Salt Lake is a continentally important staging area for millions of waterfowl. It links northern breeding areas in the U.S. and Canada with terminal wintering areas such as the Central Valley of California, the West Coast and mainland of Mexico, and the Gulf Coast[50]. It has also been recognized as North America's most important inland shorebird site[51]. Modeling conducted by the IWJV in 2013[52] established population and habitat objectives for waterfowl and shorebirds at the Great Salt Lake and surrounding wetlands. The majority of waterfowl use-days occur during fall migration, followed by the spring migration and winter seasons. Similarly, shorebird modeling indicated the highest levels of shorebird use in the fall, followed by spring. Habitat that supports submerged and emergent aquatic vegetation is essential to meet waterfowl needs during these non-breeding periods. During these times, shallow-water wetlands conducive to foraging are also essential to meet the needs of migrating shorebirds.

The Great Salt Lake and surrounding wetlands have consistently declined since historic highs in the mid-1980s, with the lake reflecting losses of nearly a million acre-feet of water per year from 2020–2022, culminating in a record-low lake elevation in 2022[53]. Invasive and exotic species such as common reed (*Phragmites australis*) also pose a significant threat to habitat for migratory birds. Continued decreases in flows to the Great Salt Lake may have catastrophic consequences for migratory birds, other wildlife, regional economies, and human health[54]. Activities that support hydrologic function and water resources in these watersheds will be crucial to sustaining wetlands in the region into the future. Further information about the Great Salt Lake Region is provided in the IWJV's Regional Wetland Profiles[55].

[47] Aldrich and Paul 2002, [48] Great Salt Lake Comprehensive Management Plan and Record of Decision 2013, [49] NAWMP 2004, [50] IWJV 2013, [51] Oring et al. 2013, [52] IWJV 2013, [53] Abbott et al. 2023, [54] Abbott et al. 2023, [55] Anticipated completion in FY 2025

Focal Wetland Landscapes

The 2024 IWJV Focal Wetland Landscapes (Box 9) represent wetlands that provide significant habitat for wetland-dependent birds in the Intermountain West. These priority areas reflect an updated version of the IWJV's 2012 Wetland Landscapes[56] that incorporate new science developed over the last decade. For example, recent advances in migratory bird tracking data have reinforced the importance of high bird-use sites with relatively small footprints that sustain flyway connectivity across arid regions, particularly in the desert Southwest and Great Basin. Collectively, the geographies highlighted in Box 7 represent strategic areas where conservation efforts can have outsized impacts on migratory bird populations. Further information about the characteristics of these Focal Wetland Landscapes is provided in the IWJV's Regional Wetland Profiles[57].

Wetland Habitat Values & Hydrologic Connectivity

Wetlands across the Intermountain West hold high ecological value and are inherently dispersed across the landscape. As such, the IWJV recognizes that many wetland complexes are not captured in the 2024 Focal Wetland Landscapes but may still provide ecosystem services and habitat values of local importance. Conservation activities not located within core wetland habitats but that support functional hydrologic processes within the same watershed may directly or indirectly benefit habitats farther down in the hydrologic gradient[58]. Localized, project-specific assessments are necessary to determine if and how conservation investments will result in clear beneficial outcomes for migratory birds. Key considerations may include whether the project supports hydrologic function at the headwaters of a watershed with priority wetlands, movement patterns and seasonal habitat use of migratory birds in the area, and how water rights may influence project feasibility and success. In addition, wetland resiliency[59] (i.e., persistence of wetland function while experiencing the effects of climate and land use change) can guide investments in wetland complexes that show stable or increasing flooding over the long term.

[56] Donnelly and Vest 2012, [57] Anticipated completion in FY 2025, [58] Yeo et al. 2019, [59] WET Resilience Module

Leveraging IWJV Science to Target Conservation Investments

The IWJV's investments in wetland science and decision-support tools have culminated in a body of technical information that supports conservation planning and monitoring in the Intermountain West. A strength of these resources is their applicability on multiple scales. These tools can inform wetland conservation at the flyway scale (e.g., to support funding entities with purview over large regions) and at the local scale (e.g., to support local efforts in identifying and monitoring wetlands within individual watersheds and basins). The following examples show how this science can be applied to support the Conservation Strategies outlined herein.

The Wetland Evaluation Tool

The WET (Box 3) provides a visual interface to track and assess surface water changes over time. Models included within WET classify wetland data and trends as outlined below:

- **Surface Water Monitoring (SWM):** The SWM module depicts the monthly extent of flooding within wetland, riparian, and agricultural systems. Historical data can be viewed as averaged monthly conditions within four approximately ten-year periods spanning the mid-1980s to 2022. Monthly conditions are provided for 2022 to the present day.
- **Hydroperiod:** The underlying surface water data shown in SWM can also be used to track wetland hydroperiods that reflect the duration of flooding within a given year and provide ecological context to wetland function and agricultural irrigation practices supporting wildlife habitat[60]. Layers depict wetlands classified by hydroperiod defined as temporary (flooded less than 2 months), seasonal (flooded between 2 and 9 months), or semi-permanent (flooded more than 9 months). Data is provided as monthly averages over approximately four ten-year periods from the mid-1980s to 2022.
- **Resilience:** Resilience data depicts long-term surface water trends (1984–2021) in temporary, seasonal, and semi-permanent wetlands[61]. Trends are displayed monthly within the averaged surface water extent from 2015 to 2021 to reflect changes influencing more recent flooding conditions.

Practitioners can leverage this data for a wide variety of applications, including:

- **Identifying resilient landscapes** for land protection projects or focused conservation funding.
- **Assessing flooding trends** to identify candidate areas for restoration when coupled with on-the-ground assessments of local conditions.
- **Tracking changes in hydroperiod abundance** within and among years. This information can be leveraged by wetland managers who are targeting projects for specific habitat needs of migratory birds.
- **Monitoring changes in surface water flooding** following implementation of on-the-ground conservation action.

[60] Cowardin 1979, [61] Mann 1945

Greater Sandhill Crane & Flood Irrigation Science

Science developed by the IWJV indicates that greater sandhill cranes rely on flood-irrigated habitats in the Intermountain West during migration[62] and for breeding. Private lands account for 78 percent of the predicted sandhill crane breeding distribution, with flood-irrigated agriculture supporting nearly 60 percent of the wetland habitats used by cranes during the breeding season[63].

The spatial data underlying this science is available in a web-based application that includes the migration network (stopover locations, Box 9), crane GPS data, predicted crane summer range, small grain footprint, and wetland data from WET[64]. Collectively, this data provides a powerful tool for targeting sandhill crane habitat conservation at flyway and local scales. For example:

- Migration network data can be leveraged to identify areas of significance for sandhill crane migrations, such as the San Luis Valley of Colorado and the Middle Rio Grande corridor of New Mexico, both of which are disproportionately influential for maintaining flyway connectivity relative to other landscapes. This stopover information can be used to direct funding for wetland conservation into areas that will impact the greatest number of birds during their annual migratory movements.
- Summer range data can be applied locally to target and monitor restoration projects and water trends within predicted habitats using WET.

Sandhill crane summer ranges are linked closely to wetlands supported by flood-irrigated grass hay agriculture. As much as 93 percent of these wetlands are concentrated in historical riparian ecosystems, mimicking natural hydrology in many instances[65]. Despite representing only 2.5 percent of irrigated lands, flood-irrigated grass hay operations support a majority (58 percent) of temporary wetlands in the Intermountain West, a rare and declining habitat for wildlife in the region. Given the tremendous effort to increase irrigation efficiency in the Intermountain West, these ecosystem benefits are at risk due to conversion to alternate irrigation systems or water leasing/acquisition programs. To address the potential loss of flood-irrigated habitats, the IWJV developed a web-based application that maps the flood-irrigated grass hay providing wetland habitat in historical, riparian ecosystems[66].

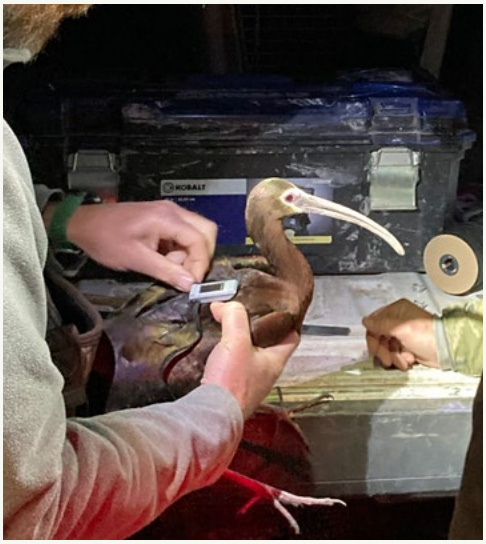
Partners can use the application to identify flood-irrigated grass hay agriculture that supports wetland habitats. This detailed mapping can inform activities such as:

- Targeting funding to support flood-irrigated grass hay agriculture in areas where it sustains riparian wetland habitats.
- Conservation activities to support breeding sandhill cranes as well as migrating waterfowl and other wildlife that rely on temporary and seasonal wetland habitats in the spring when fields are flooded.

[62] Donnelly et al. 2021, [63] Donnelly et al. 2024, [64] Sandhill Crane application, [65] Donnelly et al. 2024, [66] Flood-irrigated grass hay application

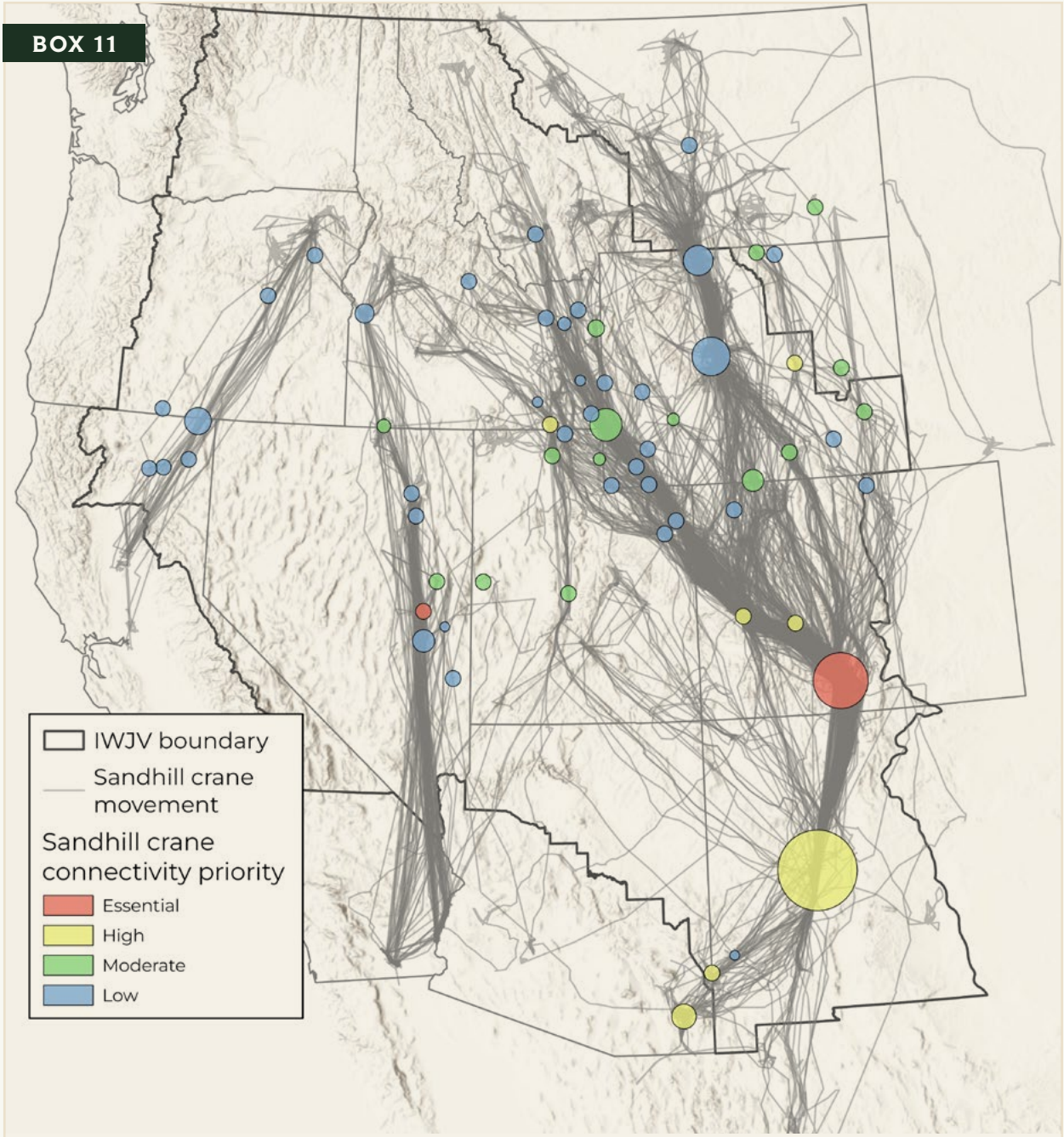
White-Faced Ibis Science

A greater diversity of wetland habitats in a given wetland landscape supports a greater variety of wetland-dependent birds, plants, and other wildlife. White-faced ibis serve as useful indicators of wetland diversity due to their reliance on semi-permanent wetlands for colonial nesting (often associated with managed wetlands) and temporary and seasonal wetlands for foraging (often associated with flood-irrigated agriculture). Ongoing research uses GPS tracking technology to collect ibis location data to inform flyway-scale models of seasonal movements, resource selection, and distribution. Collectively, this data will expand existing knowledge of white-faced ibis habitat selection and inform activities such as:



- Communicating the interconnected function of managed wetlands and surrounding flood-irrigated grass hay agriculture.
- Targeting landscapes for habitat restoration to support ibis breeding and foraging habitats.
- Planning conservation work to prioritize protection of private lands surrounding managed wetlands.

[67] Coons et al. 2022



Greater Sandhill Crane Spring Migration Networks in the Intermountain West

Sandhill crane migration networks for the Central Valley, Lower Colorado River Valley, and Rocky Mountain population segments, representing 150 individuals (2014–2022). Circles indicate spring stopover locations. Priority ranking colors are a measure of stopover site importance to maintaining crane flyway connectivity. Circle size varies by stopover location to encompass wetland, riparian, and agricultural resources tied to observed bird use. Not all areas within stopover circles represent sandhill crane migration habitat[1].

[1] Donnelly et al. 2021

Conservation Strategies

Sustaining wetlands in the Intermountain West requires a more expansive approach than one focused strictly on protecting or restoring wetland acreages. Functional habitat loss through wetland drying impacts even protected wetlands, decreasing or eliminating their value to migratory birds. This threat bypasses traditional "wetland protection" and "wetland restoration" habitat objectives that assume that protected and restored wetlands will support birds at desired levels in perpetuity. Likewise, the wetland habitat value of flood-irrigated agricultural lands can vanish due to shifts in agricultural market demand, changing water management, and water leasing or acquisition programs that may reallocate irrigation water for other uses. These new threats warrant a new and innovative approach to wetland conservation.

The wetland habitat conservation strategies for the Intermountain West we present herein fundamentally differ from those in other regions of North America, where acquisition, protection, and restoration are the leading wetland conservation approaches. Here, water is the limiting factor, so actions must align with the framework of existing water management in the West.

What the IWJV's wetland conservation strategies *are*: A set of concepts, approaches, and ideas that partners can adapt and use to sustain key wetland habitats strategically and successfully in the face of new threats and challenges.

What the IWJV's wetland conservation strategies *aren't*: A comprehensive assessment of the amount and location of habitat needed to support waterfowl, shorebirds, and waterbirds at specified goal levels and a related set of prescriptive wetland protection and wetland restoration habitat objectives.

Herein, the IWJV outlines strategies for the implementation of wetland conservation through its Water 4 program. In doing so, we also provide a framework for partners to accelerate effective wetland conservation in a rapidly changing landscape. The framework is built around attainable strategies aligned with two types of wetland habitats in the region that are managed and provide resources for migratory birds: flood-irrigated grass hay wetland habitats and managed wetlands. We also identify one area (saline lake habitats) where ongoing conservation work needs additional engagement and support. These strategies are versatile, ensuring they can be used by partners across the West. Furthermore, applying these activities within the IWJV's Focal Wetland Landscapes offers a targeted opportunity to benefit migratory birds at the flyway scale. Collectively, these strategies provide a vision for the IWJV partnership in this new era of wetland conservation.

Strategies: Managed Wetlands

Local, state, federal, Tribal, and private managed wetlands have long provided some of the most important habitats for migratory birds in the Intermountain West. These lands serve as "anchors" of wetland habitat in many landscapes and are often surrounded by flood-irrigated grass hay agriculture, forming systems that meet the seasonal needs of waterfowl, shorebirds, and waterbirds[68]. Targeted management to support wildlife has been ongoing for years in many of these geographies, presenting an important opportunity to support wetland managers in their existing and ongoing work. Funding and capacity challenges, as well as changes like decreasing water availability, may limit a manager's ability to manage these habitats to their fullest potential. Specific opportunities for IWJV and partners to support managers in sustaining or improving habitat quality on these lands are described below.

1. Identify the niche in the flyway through conservation planning

Managed wetlands typically fill an important niche for migrating and breeding waterfowl, shorebirds, and waterbirds because many of these complexes have semi-permanent wetlands in the form of emergent marshes with flooded habitat during the summer months. Many of these areas use additional flooding to support public waterfowl hunting opportunities during the fall. In contrast, the bulk of the flood-irrigated grass hay wetland habitat in the West is flooded during the spring and early summer. New remote-sensing tools like WET provide opportunities to further tailor water deliveries to managed wetlands within the context of the surrounding landscape.

For example, in regions with substantial agricultural wetlands available during spring, wildlife area managers could consider bolstering fall-flooded seasonal wetlands and summer-flooded semi-permanent wetlands (if possible within the constraints of existing water rights). Many managers have deep knowledge of the dynamics of their managed wetlands and understand the opportunities and limitations within their landscape better than anyone else. The IWJV partnership should support managers to:

- **Evaluate the area's role in providing habitat for waterfowl, shorebirds, and waterbirds** during the spring migration, breeding, molting, and wintering life cycle events in the context of the surrounding landscape. Apply the WET and migratory bird data to identify key niches for the wildlife area in providing habitat within a flyway.
- **Use this flyway-scale information to identify the habitat features needed to provide key resources to wetland-dependent migratory birds** (e.g., timing of flooding, water depth, ratio of emergent vegetation to open water).
- **Assess water supply reliability and develop options for providing the needed habitats within realistic water scenarios.** This planning is essential given our understanding of water scarcity and how it affects managed wetlands, particularly those with limited or junior water rights.
- **Communicate the importance of managed wetlands in the flyway and larger landscape through collaborative storytelling.** Use communications tactics and tools to build support for wildlife areas in terms of budgetary allocations, staff capacity, and grant funding.

[68] Downard and Endter-Wada 2013, Coons et al. 2022

2. Modernize water management infrastructure

In the face of functional wetland loss, wetland managers must have state-of-the-art water conveyance and management infrastructure to enable full operational flexibility in managing available water to maximize wetland habitat quality. The IWJV partnership should support managers with resources to:

- **Identify and help implement infrastructure improvements needed to efficiently and effectively use water supplies to provide key habitats** consistent with the previously described conservation planning. Design projects that circumvent water management infrastructure limitations. Address administrative and capacity challenges to streamline project implementation.
- **Develop proposals to attain funding from traditional wetlands conservation funding sources (e.g., the North American Wetlands Conservation Act and agency funding) non-traditional funding streams such as the Bipartisan Infrastructure Law, and new funding sources such as private foundations.** Explore the potential for water management infrastructure projects and subsequent wetland management to provide multiple ecosystem service benefits including carbon sequestration, aquifer recharge, flood attenuation, and native fisheries recovery. Multi-benefit projects, while often beyond the traditional wildlife habitat objectives of the managed wetland, can result in an expanded list of public awareness, support, and funding sources for wetland conservation work.
- **Communicate the importance of water management infrastructure projects to sustain wetland habitat despite increasing water scarcity.** Effective communications can unlock new sources of funding. Audiences include leadership of federal and state agencies that own and manage many of these resources, congressional members and staff, and public users of these wetland complexes.

3. Implement strategic water and vegetation management

Managing wetland habitats involves complex decision-making related to the purpose of the wetland; limitations in budgets, staff capacity, and water supplies; and the expectations of public and private user constituencies. Managers routinely make hard decisions when balancing multiple priorities. Maximizing habitat quality in the face of limited water supplies is essential to sustain managed wetland habitats. The IWJV partnership should support managers with resources to:

- **Manage vegetative communities on wetland tracts with reliable water supplies to produce the highest quality wetland habitat.** By strategically using water, managing vegetation, and emphasizing habitat quality over quantity, managers can remove invasive or late-succession vegetation. In turn, these actions will help them achieve targeted habitat objectives such as (a) increasing open-water habitat conditions and foraging access to aquatic invertebrates as required by shorebirds and (b) increasing moist-soil seed production and food energy for migrating and wintering waterfowl.
- **Innovate water management approaches to fill the habitat niche(s) identified for the managed wetland.**
- **Support the manager's vision for the wetland and engage support from partners**, as needed, in wetland habitat restoration, enhancement, and management.
- **Support increases to wildlife area operational budgets and staff capacity** to manage public wetlands strategically.
- **Support the development of incentives for managing private wetlands,** recognizing the multiple benefits these privately held habitats provide.

Strategies: Flood-Irrigated Grass Hay Wetland Habitats

As previously described, the 818,000 acres of flood-irrigated grass hay agriculture in the Intermountain West provide important temporary and seasonal wetland habitat for migratory birds. Approximately 93 percent of these lands are located in historical riparian corridors where flooding mimics natural hydrologic functions and may provide ecosystem services like groundwater recharge and delayed return flows to streams and rivers[69]. Spring habitat on working lands complements summer and fall flooding on managed wetlands where managers can target water resources for habitat creation during drier times of the year; therefore, keeping flood irrigation on the landscape at critical times such as spring migration should be a priority. Specific strategies to sustain these important wetland habitats for people and wildlife are described below.

1. Tell the story of flood-irrigated grass hay wetland habitats

Flood-irrigating pastures and hay meadows is a long-standing practice. However, research showing the value of these irrigated agricultural habitats to migratory birds and other ecosystem services is relatively recent. As such, it is essential to communicate the benefits provided by this practice and the systems that sustain it. The IWJV partnership can promote and expand this narrative in the following ways:

- **Collaborate with and support agricultural organizations, irrigators, and livestock producers that manage flood-irrigated grass hay meadows in showcasing their contributions to migratory bird habitat conservation.** Communicate the value of these wetland habitats to a wide range of decision-making audiences to raise awareness of the multiple ecosystem services provided by this irrigation practice. Audiences include water managers, congressional members and staff, state engineers' offices, water commissioners, traditional conservation organizations, and key federal agencies engaged in irrigation water management (e.g., NRCS, Bureau of Reclamation).
- **Implement a robust science-to-implementation effort** that helps practitioners and decision-makers access, interpret, and apply the relatively new body of science that articulates the value and function of flood-irrigated grass hay wetland habitats.
- **Build the conservation of these habitats into federal and state programs** to unlock funding that will support partners in implementing on-the-ground conservation practices.

[69] Donnelly et al. 2024

2. Modernize flood irrigation infrastructure

For many years, the focus of irrigation water management by NRCS and other agencies has been addressing water quantity concerns by improving agricultural irrigation efficiency. However, supporting continued flood irrigation in areas where it meets the common goals of agricultural producers and other stakeholders offers an important opportunity to sustain both wetland habitats for migratory birds and, in some cases, other hydrologic benefits. Investing in flood irrigation infrastructure can improve the effectiveness of irrigation management actions, creating benefits for producers and enabling more strategic water application to benefit wildlife.

The IWJV partnership can support flood irrigation modernization as follows:

- **Identify lands with potential high migratory bird value where flood-irrigation modernization would help producers improve forage production and habitat** via more timely spring flooding. IWJV flood irrigation mapping products can be used to locate opportunity areas for these upgrades.

  Example: Northern Pintails move through the SONEC region in March and early April, so improving flood-irrigation infrastructure can help producers effectively flood their meadows during this crucial early spring migration window.

- **Help partners implement modernization projects** that prepare producers to effectively and efficiently flood irrigate hay meadows and pastures to produce high-quality migratory bird habitat. Support the development of funding pools focused on flood irrigation modernization in key landscapes to ensure these projects are evaluated against each other rather than in statewide pools prioritizing irrigation efficiency. Bring together groups with shared values (fisheries communities, land trusts, agricultural groups) to leverage multiple funding sources to ensure conservation success.

- **Build flood irrigation modernization into larger landscape-scale projects** (e.g., NRCS Watershed and Flood Prevention Operations Program) that use a variety of irrigation treatments and should include flood irrigation as an appropriate practice. A systems-based approach can sustain important flood-irrigated grass hay wetland habitats while achieving water use efficiency through sprinkler irrigation and other practices at the larger project scale. There is no one-size-fits-all solution to irrigation practices.
- **Connect partners to flood-irrigation modernization innovations** including labor-saving automation such as "auto-tarps," remote monitoring systems, and, in some instances, hybrid approaches that install modern flood-irrigation infrastructure and sprinklers to enable early-season flooding and late-season sprinkler irrigation.

3. Accelerate the pace of conservation easements

Wetlands, streams, and riparian areas—the "green ribbons" of the Intermountain West—are primarily located on private land and were historically managed following Euro-American colonization as large working ranches. Well-stewarded working ranches offer intact wildlife habitat managed across public and private boundaries through fee-title ownership and public grazing leases. These lands are increasingly threatened by development and fragmentation. Rural subdivisions have been shown to decrease biodiversity[70] and can alter water management[71].

Conservation easements offer an outstanding tool for keeping ecologically important ranches intact, sustaining water management systems that support wetland and riparian habitats important to migratory birds. Land trusts throughout the Intermountain West have effectively protected these important habitats despite funding and capacity limitations. The IWJV partnership can support conservation easement acquisition to protect wetland habitats as follows:

- **Identify lands with high migratory bird value that exhibit resilient water resources.** Work collaboratively with land trusts to protect these areas through conservation easements and support land trusts in their strategic planning to prioritize projects in these areas.
- **Support the NRCS and the land trust community in developing mechanisms to increase the pace and scale of conservation easement implementation** through the Agricultural Conservation Easement Program–Agricultural Lands Easements (ACEP-ALE) program[72]. This includes establishing partner easement specialist capacity in state offices, fully utilizing the certified entities authorization, developing innovative approaches for implementing ACEP-ALE to benefit historically underserved producers, and identifying other means for the NRCS and land trusts to work collaboratively and efficiently to acquire conservation easements.
- **Champion strong conservation funding for ACEP-ALE and complementary programs** that can support the acquisition of conservation easements.
- **Communicate the public benefit of working lands conservation easements that protect high-value and resilient flood-irrigated grass hay wetland habitat for migratory birds.** Audiences include congressional members and staff, key federal agencies engaged in landscape conservation (e.g., NRCS, USFWS), the land trust community, traditional conservation organizations, and livestock producers.
- **Support efforts to streamline and more efficiently implement NRCS's Regional Conservation Partnership Program** so that conservation resources are strategically focused in high-priority areas.

[70] Maestas et al. 2003, [71] Cox and Ross 2011, [72] DNRCS Agricultural Land Easements

Opportunity Area: Saline Lakes

Surface water declines that adversely impact wetlands throughout the Intermountain West also contribute to the decline of saline lake habitats. It is increasingly urgent to sustain the function of saline lakes for a suite of reasons, including migratory bird habitat, public health, and industry (such as brine shrimp harvesting at the Great Salt Lake). The IWJV has long recognized the enormous importance of saline lakes to shorebirds and, in many cases, waterfowl and waterbirds. The 2013 Implementation Plan Shorebird Chapter[73] included substantial details on shorebird population objectives, habitat needs, and habitat threats. It included 18 Shorebird Key Sites representing crucial habitats for shorebirds across the Intermountain West. Of the habitats included in these sites, saline lakes were the most important to spring- and fall-migrating shorebirds. The IWJV's past conservation planning remains relevant in capturing the essential role saline lakes play in shorebird ecology by establishing priorities for shorebird habitat conservation.

Saline lakes are inherently at the bottom of watersheds and often lack dedicated water rights, so solutions to water scarcity are highly complex and require collaborative action. Because saline lake declines result from watershed-scale processes, conservation strategies need to be tailored to specific geographies and developed at multiple levels, from land management to conservation programs and water policy. Watershed-scale solutions can be supported by strategies that sustain hydrologic function in wetland habitats. For example, managed wetlands are often located within saline lake systems, and partners can leverage the strategies described above to support managers of these habitats. Further, many saline lakes are fed by watersheds that include flood-irrigated grass hay agriculture. The interconnected nature of these systems necessitates solutions that meet the needs of both agricultural producers and stakeholders downstream. Actions that support overall functional hydrology in saline lake watersheds will help sustain water resources and migratory bird habitats into the future.

Partners within saline lake watersheds are making substantial progress toward finding solutions in the face of complex challenges created by managing water for multiple uses. For example, the 2024 designation of the Great Salt Lake Sentinel Landscape Partnership[74] recognizes overlapping priorities of conservation, working lands, and national defense by the USDA, Department of Defense, and Department of the Interior within areas immediately surrounding the Great Salt Lake. In the same geography, the state of Utah is championing legislation to benefit the Great Salt Lake through initiatives such as HB453, which adds protection for the waters of the Great Salt Lake and ensures extraction industries work with state leaders to improve the health of the lake and surrounding wetlands[75]. At the national level, new science is in development to assess saline lakes and inform conservation decision-making, including an Integrated Science Strategy led by the U.S. Geological Survey[76]. The conservation community will play a key role in translating and implementing this new science in the future.

Watershed-scale solutions for saline lakes will require engagement from partners at all levels. Overall success will only be possible through collaborative, proactive, non-regulatory actions focused on sustaining saline lake habitats. The IWJV encourages the development of site-specific habitat goals and strategies for saline lake conservation that are driven by local input to ensure durable conservation outcomes. The IWJV will further develop tools and resources to support local partners in their conservation of these important places.

[73] 2013 IWJV Implementation Plan: Shorebirds, [74] Great Salt Lake Sentinel Landscape, [75] Utah Senate 2024, [76] Frus et al. 2023

Success in Wetland Habitat Conservation

In the Intermountain West, successful wetlands conservation requires supporting innovative solutions that sustain water resources in the face of wetland drying and other rapid landscape changes. Activities that build landscape resilience, such as managing water strategically, preserving or restoring hydrologic processes, and enhancing ecosystem function, should be prioritized. Continued science development for conservation planning, prioritization, and monitoring is essential. Ensuring stakeholders can access, interpret, and apply this science is also necessary to integrate new information into conservation planning and delivery.

The developing field of science to implementation (or technical transfer) helps practitioners effectively link on-the-ground needs with the best available science to support their activities. Tools like WET can be used to track surface water presence over time, evaluate long-term flooding trends, and determine whether on-the-ground implementation is meeting targeted management needs. Continued research and technical transfer efforts by the IWJV and partners must evaluate wetland trends in key landscapes and link these changes to seasonal habitat requirements for migratory birds, identifying emerging bottlenecks and informing conservation decision-making within the diverse landscapes of the Intermountain West. By focusing efforts on key habitats such as flood-irrigated grass hay and managed wetlands while supporting collaborative, partnership-driven work in saline lakes systems, conservation investments can be leveraged to maximize on-the-ground success for people and wildlife.

Within Water 4, success will be measured by the IWJV's ability to build and enhance durable partnerships that sustain wetlands and result in shared water resource benefits for multiple stakeholders. In support of this goal, the IWJV will advance a multidisciplinary approach to wetland conservation that integrates government relations, conservation program innovations, science development and implementation, and compelling communications and storytelling alongside more traditional wetland protection and restoration practices. Ultimately, as a partner-driven wildlife habitat organization, the success of Water 4 will be the conservation and restoration of wetland bird habitat through innovative approaches and new and continued partnerships.

CHAPTER SIX:

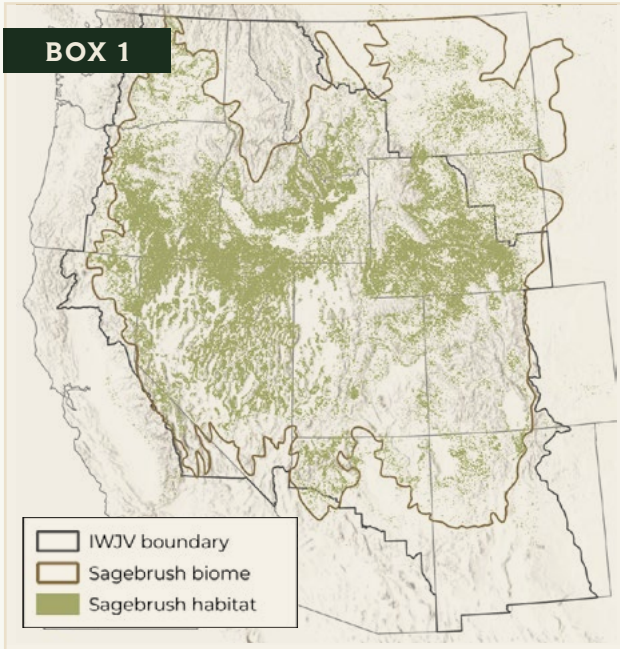
Sagebrush Ecosystems

Introduction

Sagebrush (*Artemisia spp.*) once covered roughly 247 million acres in western North America (Box 1). Today, this threatened landscape is half its original size and shrinking due to large-scale threats like catastrophic wildfire and invasive annual grasses. Sagebrush rangelands provide important wildlife values, including habitat for 350 species of conservation concern. Deep-rooted western livelihoods, from Native American cultural traditions to ranching to big game hunting, all rely on healthy sagebrush rangelands (Box 2)[1].

The IWJV's work in sagebrush rangelands was initiated through a partnership with the NRCS in 2010. In 2016, IWJV expanded this work across ownership boundaries to encompass federal lands managed by the Bureau of Land Management (BLM). The initiative is now known as Partnering to Conserve Sagebrush Rangelands. Through this effort, we have grown the network of sagebrush partners and enacted cross-boundary management and enhancement of sagebrush rangelands for people, wildlife, and the economy.

BOX 1



The Sagebrush Biome

Sagebrush habitat derived from LANDFIRE Biophysical Settings (2016).

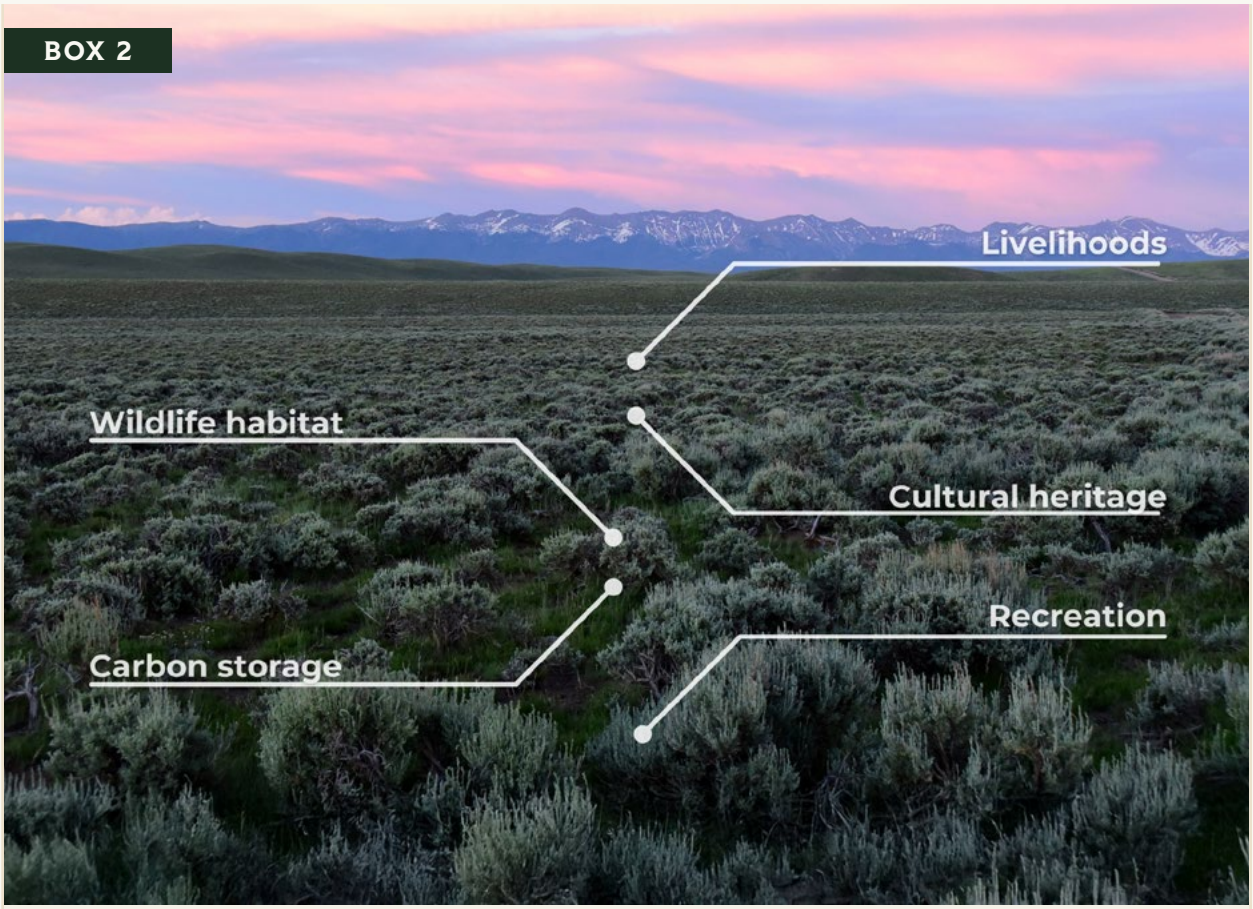
This partnership focuses on:

- Bringing people together to energize and accelerate effective and lasting conservation;
- Catalyzing implementation of on-the-ground projects that work for wildlife and communities;
- Communicating about successful conservation efforts and learning from these achievements; and
- Bridging science and implementation.

Our work in sagebrush ecosystems focuses on addressing fire, fuels, and invasive annual grasses; restoring and retaining riparian and wet meadow habitats; removing encroaching conifers; supporting outcome-based grazing projects; and, supporting efforts focused on big game migration and habitat stewardship (Box 3).

[1] Wisdom et al. 2005

BOX 2



What Do Sagebrush Ecosystems Provide?

Wildlife habitat
Sagebrush steppe is home to a suite of wildlife species, from the iconic Greater Sage-grouse to pronghorn and mule deer. Many of these species are sagebrush steppe obligates, meaning they rely on sagebrush habitats for important parts of their life cycles.

Carbon storage
Shrublands and grasslands contain around 25 percent of carbon stored in western ecosystems[1]. The majority of this carbon resides underground in the form of soil organic carbon. Protecting this carbon from loss via tilling, development, invasive annual grasses, or wildfire is a strong benefit of sagebrush conservation.

Livelihoods
Many sagebrush rangelands are working landscapes, supporting the livelihoods of ranchers, western communities, and more. Intact sagebrush ties people and wildlife together across this landscape.

Cultural heritage
Wide-open spaces are part of the cultural heritage of the West. People have inhabited the Intermountain West for time immemorial, and strong relationships with place anchor people with a wide variety of cultural backgrounds to the landscape.

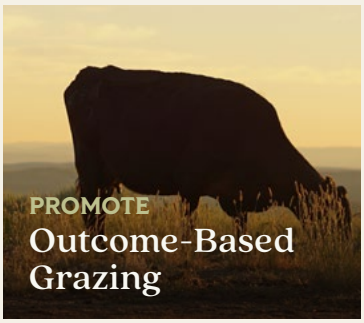
Recreation
Sagebrush steppe is used for recreation by people who enjoy hiking, backpacking, hunting, fishing, rafting, biking, wildlife watching, foraging, and more. These activities support local economies.

[1] Zhu and Reed 2012 (Ch. J)

BOX 3

The IWJV's Sagebrush Focus Areas

Using science, capacity, & communications to...



Sagebrush Ecosystems & Land Ownership of the Intermountain West

The sagebrush biome is known for its expansive yet shrinking extent, diverse vegetation communities, multitude of plant and wildlife species, and important role as a working landscape. Vegetation communities and the wildlife supported vary substantially, from mountain big sagebrush (*A. tridentata subsp. vaseyana*) communities occupying mesic and productive high-elevation sites, to black sagebrush (*A. nova*) communities in dry, rocky areas with sandy soils (Box 4).

The sagebrush biome is generally considered semiarid. Substantial variability in climate, soils, elevation, topography, and disturbance history further define the distinct vegetation communities that compose the sagebrush biome[2]. The sagebrush biome is also characterized by differing natural disturbance regimes and histories of human disturbance. Historically, natural disturbance was driven primarily by wildfire, which varied in frequency, scale, and intensity and was shaped by climate and local topography[3]. The legacies of past and present human disturbances, including land conversion, mining and energy development, tree and sagebrush harvest, overgrazing, and others, also shape sagebrush vegetation communities.

The ecological variability of the sagebrush biome creates habitats for a diversity of species. Many of the Intermountain West's most iconic wildlife species, including Greater Sage-grouse (*Centrocercus*

Continued on next page →

[2] Chambers et al. 2017, Remington et al. 2021 Chapter A, [3] Remington et al. 2021 Chapter J (p115)

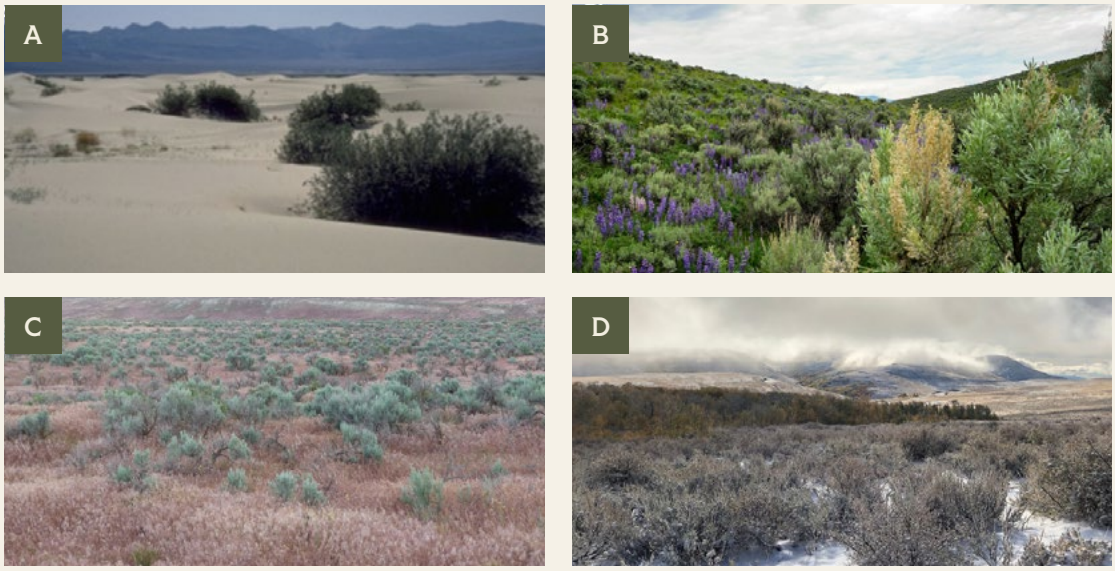
urophasianus), Gunnison Sage-grouse (*Centrocercus minimus*), mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and pronghorn (*Antilocapra americana*) make their home in the sage. In addition to sage-grouse, there are several sagebrush obligate migratory birds that are emblematic of the biome and the focus of considerable conservation investments, including Brewer's Sparrow (*Spizella breweri*), Sagebrush Sparrow (*Artemisiospiza nevadensis*), and Sage Thrasher (*Oreoscoptes montanus*; Box 5). Research produced and supported by the IWJV indicates that targeted conservation actions for sage-grouse often benefit these other birds[4].

Across land ownerships, the sagebrush biome plays an important role as a landscape of multiple uses[5]. Almost two-thirds of the sagebrush-dominated ecosystems in the United States occupy public lands; of that public land, approximately half is managed by the BLM[6]. The other third of sagebrush habitat is primarily privately owned. These private lands are typically ranchlands in valley bottoms with deeper soils and greater water availability, providing important habitats for wildlife in an arid landscape where water is limited but critical for life. The sagebrush biome supports a multitude of uses and benefits to people, including grazing, Tribal uses, energy development and mining, hunting, and recreation.

A thorough review of the geography of the sagebrush biome, its history, and its ecology can be found in the Sagebrush Conservation Strategy–Challenges to Sagebrush Conservation[7].

BOX 4

Diverse Sagebrush Communities



A. Black sagebrush (*Artemisia nova*) with little understory in the Inyo Mountains, California. Photo: Marc Hosocsky.

B. Basin big sagebrush (*A. tridentata ssp. tridentata*) with a lush understory in southwest Montana.

C. Wyoming big sagebrush (*A. tridentata ssp. wyomingensis*) heavily invaded by cheatgrass (Bromus tectorum) in Malheur County, Oregon. Photo: Bruce Taylor.

D. Mountain big sagebrush (*A. tridentata ssp. vaseyana*) in the Trout Creek Mountains of Oregon.

[4] Donnelly et al. 2017, Holmes et al. 2017, [5] Remington et al. 2021 Chapter B, [6] Knick and Connelly 2011, [7] Remington et al. 2017

BOX 5

Declining Sagebrush Birds

A. Greater Sage-grouse (*Centrocercus urophasianus*), an icon of the sagebrush ecosystem, requires healthy sagebrush habitat. Photo: Jeremy Roberts.

B. The Sage Thrasher (*Oreoscoptes montanus*) needs plenty of sagebrush cover to conceal it while it hunts for insects on the ground. Photo: Tom Koerner.

C. The Sagebrush Sparrow (*Artemisiospiza nevadensis*) holds large breeding territories within intact sagebrush steppe, often returning to the same sites year after year. Photo: Tom Koerner.

D. Brewer's Sparrow (*Spizella breweri*) is the most abundant bird across the sagebrush steppe. Photo: Tom Koerner.

Threats to the Sagebrush Biome

Loss and degradation of the sagebrush biome have garnered substantial focus in recent decades. However, the threats to the sagebrush biome—which include invasive annual grasses, altered fire regimes, conifer expansion, loss of water resources and wet habitats, free-roaming equids, land use change, and more—have not abated, resulting in loss of around 1.3 million acres per year of intact sagebrush habitat over the last 20 years[8]. Below, we provide a brief overview of these threats and their impacts on the sagebrush biome in the Intermountain West, focusing on threats addressed by this partnership: fire, fuels, and invasives; conifer expansion; loss of water resources and wet habitats; and exurban development and land use change. We acknowledge that many of these threats are complex and interrelated but address them separately to discuss the nuances of each. Resources for additional information on each threat are provided below.

[8] Doherty et al. 2022

Landscape Changes

There are rapid ecosystem changes occurring in the sagebrush biome, including more frequent and severe droughts, flooding, and wildfires; altered patterns and modes of precipitation[9]; and increased temperatures. These changes will continue to influence fire regimes in the sagebrush biome through predicted increases in average and extreme temperatures and more xeric conditions. Although it is uncertain exactly how climate change will affect ecosystems in the future, climate projections provide information on likely future scenarios. Average increases in temperature for the sagebrush biome[10] of 1–3°C are predicted by 2020–2050 and 2–7°C by 2070–2100[11]. Largest increases in temperature are expected in the north and northeastern portion of the sagebrush biome. Although predictions for future precipitation are overall less certain, most models suggest slightly increasing mean precipitation. However, the duration and severity of drought is also expected to increase in the western United States[12], especially in the southern portion of the sagebrush range[13]. These predicted changes will likely continue to contribute to larger wildfires as a result of both decreased fuel moisture and increased extreme fire weather[14]. As these changes progress, understanding the impacts on existing and new stressors will be critical to durable management efforts.

Invasive Annual Grasses

Because of their extent, rapid spread, and negative ecological impacts, invasive annual grasses are one of the primary threats to sagebrush ecosystems. Invasive annual grasses, including downy brome (*Bromus tectorum; also known as "cheatgrass"*), medusahead (*Taeniatherum caput-medusae*), and ventenata (*Ventenata dubia*), are rapidly increasing across most of the sagebrush biome, threatening core sagebrush habitats[15]. Although expanding presence of invasive annual grasses are being seen in all regions, susceptibility to invasive annual grasses varies substantially across the sagebrush biome, with warm and dry areas most susceptible[16]. Invasive annual grasses are spreading without fire[17], but the invasive annual grass-wildfire cycle accelerates their spread. Invasive annual grass-dominated systems are more susceptible to wildfire because short-statured annual grasses dry out quickly and create continuous fuel beds, increasing the likelihood of large-scale fires[18]. Invasive species may also outcompete native species where fire occurs, driving a cycle of invasive annual grass dominance and increasing fire occurrence and severity[19]. As threats of invasive annual grass invasion increase, leading to altered and increased wildfire risk, it is increasingly important that sagebrush conservation efforts are strategic, focused on growing core areas, and collaborative[20].

[9] Chambers et al. 2017, Remington et al. 2021 Chapter L, [10] Representative concentration pathways 4.5 and 8.4; see Remington et al. 2021 Chapter L, [11] Palmquist et al. 2016a, Chambers et al. 2017, Remington et al. 2021 Chapter L, [12] Dai 2013, [13] Palmquist et al. 2016b, [14] Remington et al. 2021 Chapter L, [15] Remington et al. 2021 Chapter K, Maestas 2022, Kleinhesselink 2023, [16] Chambers et al. 2017, Maestas et al. 2019, Chambers et al. 2023, [17] Smith et al. 2023, [18] Brooks et al. 2004, Balch et al. 2012, [19] Brooks et al. 2004, Balch et al. 2012, Coates et al. 2016, [20] Maestas 2022

Fuels & Altered Fire Regimes

Wildfire historically played an important ecological role in sagebrush ecosystems, but today, altered fire regimes drive rapid ecosystem shifts that are a central concern for sagebrush conservation and management[21]. Prior to Euro-American colonization, historical fire regimes varied in frequency, scale, and severity throughout the sagebrush biome, primarily influenced by climate and past disturbance on fuel loads[22]. Historically, fire in some sagebrush ecosystems occurred in the early growing season, at roughly 50-year intervals. It resulted in landscape heterogeneity, with native perennial grasses and emergent shrubs dominating burned patches[23]. Indigenous burning was also prevalent for a variety of reasons, such as creating habitat for culturally important plant and wildlife species[24]. Fire remains an important ecological process on the landscape, and prescribed fire an important tool to mimic natural fire regimes. However, contemporary changes in the frequency and intensity of fire are a threat to sagebrush ecosystems.

After colonization by Euro-Americans, fires broadly became less frequent and intense due to wildfire suppression, prohibition of Indigenous burning, heavy grazing, and sagebrush and woodland removal[25]. In contemporary times, fires have increased in size and severity, as widespread invasion by annual grasses has increased fine fuels and fuel continuity, ramping up fire in a fuel-limited system[26]. As a result, between 2000 and 2018, more than six million acres of shrub-dominated ecosystems have burned on federal lands[27], exceeding burned area in forests in 14 of the past 21 years[28]. As fires burn, recovery of native sagebrush and perennial bunchgrass systems varies depending on several variables such as climate, prefire invasive annual grasses presence, and disturbance history. For example, previously invaded, warmer, and drier locations at lower elevations are more likely to become dominated by invasive annual grasses and continue the invasive annual grass-wildfire cycle[29]. Failure to recover after fire results in the degradation of habitats for wildlife; loss of recreational, cultural, and aesthetic values; loss of livestock forage; and reduction in ecosystem function. Wildfire risk reduction is essential for many components of a prospering sagebrush ecosystem, including community protection, economic prosperity, and habitat function and resiliency.

[21] Department of the Interior 2015, Crist 2023, [22] Miller and Heyerdahl 2008, Bukowski and Baker 2013, Remington et al. 2021 Chapter J [23] Miller and Rose 1999, Simic et al. 2023, [24] McAdoo et al. 2013, [25] Miller et al. 2011, Simic et al. 2023, [26] Brooks et al. 2004, Balch et al. 2012, [27] Remington et al. 2021 Chapter J, especially Figure J1, [28] Crist 2023, [29] Chambers et al. 2014, Smith et al. 2023

Conifer Expansion

At the biome scale, pinyon and juniper species are increasing their footprints, both expanding into former sagebrush habitats and increasing in density within existing pinyon-juniper woodlands (Box 6) [30, 31]. Increased tree cover is thought to be a result of climate change, historical management, fire suppression, and tree population dynamics[32], although research on this topic is not conclusive in some areas, and these causes vary spatially. Research has established that expansion of native conifers in historical sagebrush habitats degrades habitat for sage-grouse, a major threat to this species in many parts of its range[33]. Sage-grouse will avoid otherwise suitable habitats even when tree cover is low (>4 percent cover), meaning that a few trees per acre can degrade sage-grouse habitat[34]. As trees expand into sagebrush-dominated landscapes, they also decrease perennial grass, forb, and shrub cover, reducing habitat and forage for sagebrush-dependent wildlife and livestock and making sagebrush systems less resistant to invasive annual grasses[35]. Conifer removal efforts targeting early successional conifer expansion in core sage-grouse habitat have been successful at improving outcomes for sage-grouse[36]. These efforts additionally improve habitats for other sagebrush-dependent songbird species[37]. Across the sage-grouse range, collaborative, partnership-driven efforts are working at the landscape scale to increase targeted conifer removal.

These efforts aim to improve core sage-grouse habitat while balancing the needs of other species (e.g., Pinyon Jays) and protecting areas of old growth pinyon-juniper and culturally important areas for Tribes.

Loss & Degradation of Water Resources

In the West, wet or mesic habitats cover a small fraction of the landscape, yet these habitats are disproportionately important for both wildlife and livestock[38]. Despite their paramount importance as biodiversity hotspots, many springs, streamside riparian areas, and upland ephemeral wet meadows have become disconnected from their floodplains through head cutting, gully erosion, channel incision, vegetation loss, and other forms of degradation, reducing natural resilience to drought and capacity for water and carbon storage[39]. Past management, including improper grazing management, vegetation removal, and development of water infrastructure, has caused degradation and loss of wet habitats[40]. Contemporary management and restoration approaches, such as appropriate grazing and low-tech process-based restoration practices, can be effective at restoring these wet areas[41]. Such methods are gaining momentum, and research shows how their implementation can improve resilience to drought, wildfire, and climate change, as well as wildlife habitat[42]. Widespread degradation provides ample opportunities for wet habitat enhancement across the West, and prioritization is needed to maximize the ecological and human benefits of this work.

[30] Miller et al. 2008, Filippelli et al. 2020, Kleinhesselink 2023, [31] This chapter focuses on expansion of conifers into sagebrush habitats. Local declines of pinyon-juniper woodlands as a result of drought, wildlife, and insect or disease outbreaks is covered in the Forest Ecosystems chapter of this plan. , [32] Miller and Rose 1999, Shriver et al. 2024, [33] Baruch-Mordo et al. 2013, Severson et al. 2017, [34] Baruch-Mordo et al. 2013, [35] Chambers et al. 2014, Morford et al. 2022, [36] Severson et al. 2017, Olsen et al. 2021, [37] Baruch-Mordo et al. 2013, [38] Donnelly et al. 2016, Donnelly et al. 2018, [39] U.S. Environmental Protection Agency 2006, Perry et al. 2011, Norton et al. 2014, Nahlik and Fennessey 2016, [40] Chambers and Miller 2004, [41] Swanson et al. 2015, Wheaton et al. 2019, Norman et al. 2022, [42] Bouwes et al. 2016, Silverman et al. 2017, Fairfax and Whittle 2020, Jordan and Fairfax 2022, Norman et al. 2022

BOX 6

Conifer Expansion Threatens Sagebrush Ecosystem

Historical imagery shows how conifers have been expanding their footprint and infilling existing woodlands over time, like this example in Oneida County, Idaho. Historical images from the U.S. Geological Survey's Single Frame Archive from the 1940s through the 1970s are compared to current satellite imagery. To view historical imagery in more areas, see the Landscape Explorer.

Exurban Development & Land Use Change

Over the last several decades, exurban development and land use change have become increasingly evident in the sagebrush biome. Expansion of both urban and rural communities has increased the footprint of development on the landscape, adding stress and pressure on wildlife and natural resources across the West and rapidly fragmenting intact sagebrush habitat. States in the Intermountain West experienced some of the highest population growth between 2010 and 2020[43], and most of these states continued to grow between 2021 and 2023[44]. Between 2010 and 2020, the states with the greatest increases in rural population were North Dakota, Utah, Idaho, Montana, and Washington, ranging from 8.3 to 12.5 percent population growth over that period[45]. In a study addressing loss of natural vegetation cover on private lands in northwestern states between 2001 and 2011, some regions experienced up to 12 percent loss of vegetation. These changes were mostly accounted for by increases in housing development, followed by cropland conversion[46]. The Landscape Explorer tool from Working Lands for Wildlife uses historical imagery to show striking examples of development and land conversion[47]. Although these changes have brought opportunities for economic growth and for more people to connect with nature, unintended consequences to ecosystems from land conversion and other development, recreation, and other impacts are mounting. Natural resource managers must find solutions that minimize impacts for future generations and preserve the intact, open spaces of the West.

Other Threats to the Sage

A suite of other factors contribute to the loss and degradation of sagebrush habitats. Locally, conversion of sagebrush habitat, unmanaged recreation, growing populations of free-roaming equids, and other factors contribute to the 1.3 million acres of sagebrush lost each year[48]. These threats are covered in greater detail in the Sagebrush Conservation Strategy[49].

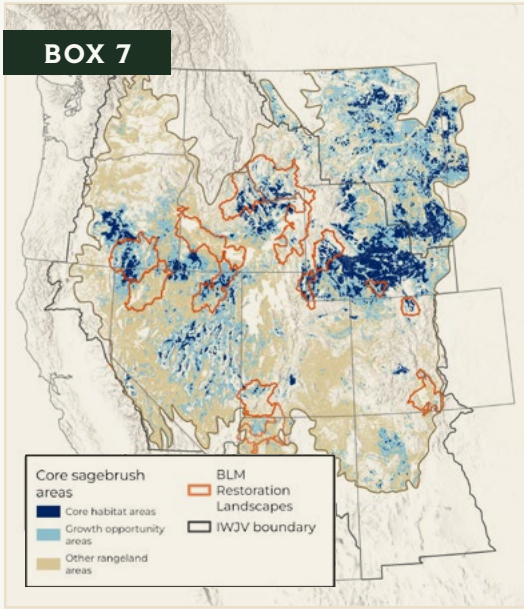
[43] Pew Charitable Trusts 2021, [44] U.S. Census Bureau 2023, [45] Dobis et al. 2021, [46] Hansen et al. 2021, [47] See the Landscape Explorer tool, [48] Doherty et al. 2022, [49] Remington et al. 2021

Priority Geographies

The IWJV supports our partners in implementing strategic, cross-boundary, science-based approaches to sagebrush management[50]. As a partner-driven organization, the IWJV does not prescribe to our partners where they should invest in sagebrush ecosystems. Rather, we attempt to support their efforts in their self-identified focal geographies or the development of geographic priorities when requested. We prioritize our support of managing and conserving intact sagebrush habitats (defending the core) and their expansion, when possible, through active management efforts (growing the core). Core sagebrush habitats are typically characterized as large patches of sagebrush plant communities dominated by sagebrush, native perennial grasses, and forbs and are devoid of trees and major human developments. The IWJV supports our partners in applying a variety of map products that help prioritize and guide the strategic application of conservation efforts. These include the Sagebrush Conservation Design, Threat-Based Ecostate Maps, and many other locally developed map and GIS products (Box 7)[51].

We recognize that effective sagebrush conservation and management requires more than identifying strategic locations based on ecological attributes. A variety of factors contribute to the success or failure of efforts we support. For example, conservation efforts are unlikely to succeed without the support of necessary partnerships, policy, and funding. The IWJV will not only identify priority geographies for our work, but identify which elements of a potential project may require additional attention. For example, perhaps a local collaborative wants to address invasive annual grasses in their geography and has strong partnerships, adequate funding, and a favorable political climate. However, they lack a spatial strategy for addressing the annual grass threat in their planning area. The IWJV Science to Implementation staff could support the effort either directly, by assisting the collaborative with geospatial tools and landscape prioritization, or indirectly, through our network of partners with expertise on this topic (such as the University of Wyoming Institute for Managing Annual Grasses Invading Natural Ecosystems)[52].

BOX 7



Partner Priority Landscapes in the Sagebrush Biome

BLM Restoration Landscapes and Forest Service Wildfire Crisis Landscapes within the sagebrush biome overlaid on sagebrush ecological integrity from the Sagebrush Conservation Design. Blue areas show core sagebrush areas where habitat remains intact, while light blue areas show sagebrush habitat experiencing threats such as invasive annual grasses and conifer expansion. Other rangeland areas are highly degraded and have a low likelihood of returning to intact sagebrush habitat.

[50] Western Governors' Association 2020, Doherty et al. 2022, [51] Doherty et al. 2022, Threat-Based Land Management,
[52] Institute for Managing Invasive Grasses Invading Natural Ecosystems

Conservation Strategies & Practices

IWJV's conservation strategies and recommended practices in sagebrush ecosystems support the goals of our work in the sagebrush biome: to address catastrophic wildfire and hazardous fuels, restore and sustain hydrologic function, remove expanding conifers, promote outcome-based grazing, and support partners on big game conservation efforts (Box 3). These strategies leverage our approach—building partnerships, growing capacity, bridging science and implementation, and engaging in innovative communications efforts—toward these goals.

Conservation Strategies

To address pressing threats to sagebrush habitats, the following overarching strategies will be employed to accelerate effective conservation in a rapidly changing landscape.

1. Build and strengthen relationships

Sagebrush conservation is directly related to the people who live and work in these beloved landscapes. To implement durable and effective sagebrush conservation, actions must result in co-benefits that meet the needs of multiple stakeholders. It is essential to build connections that bridge knowledge, funding, and capacity gaps by exploring shared values that will sustain habitats across the sagebrush ecosystem and migratory bird flyways.

Building relationships with partners working within the sagebrush ecosystem continues to be a priority for the IWJV. Work done prior to this implementation plan has resulted in a strong foundation of partnerships with NGOs, state and federal agencies. We will continue to build connections with partners across professional and jurisdictional boundaries to achieve a vision of catalyzing collaborative conservation efforts that integrate bird and habitat conservation. Priority work will focus on broadening our partnership to identify new stakeholders and additional innovative ways to address the immense challenges this system is facing.

Due to the IWJV's long-lasting partnerships within the sagebrush ecosystem, we will continue to embark on new endeavors to support partners as well as lead efforts to frame new ways of conducting collaborative habitat enhancements and management that benefit communities, wildlife, and habitat well into the future.

2. Accelerate the pace, scale, and reach of sagebrush habitat conservation delivery

Ensuring sagebrush rangelands will be sustained into the future requires an investment in the human capacity needed to implement on-the-ground actions to address current and future threats. Conservation capacity, or the human capital needed to implement projects and facilitate collaborative efforts at a desired pace and scale, is essential to sustaining and increasing the pace of sagebrush work across the Intermountain West. As efforts centered around sustainable sagebrush rangeland management, such as fuels reduction and ecosystem resilience and sustainability, additional capacity will be needed to deliver strategic management and restoration efforts across ownership boundaries. For critical functions like partnership facilitation and project planning and implementation, additional people power connected to local communities is needed to carry forward new and ongoing efforts.

The IWJV has a proven record of establishing and supporting critical partnership capacity for dedicated adaptive management[53]. We will develop capacity in identified priority landscapes that have partner support and planned conservation efforts that can lead to beneficial outcomes for communities and wildlife. As we develop new partnerships and work with existing partners, we will seek out strategic opportunities to support capacity positions that meet the needs of our partners and fill capacity gaps that may be difficult for other organizations to fill.

3. Bridge science and implementation to ensure existing knowledge can be used to strengthen on-the-ground sagebrush habitat management

Bridging knowledge and action is often a challenge in conservation management. Conservation science is not always co-produced and may not address specific needs of managers[54]. Many barriers to the application of knowledge in land management decisions exist within both research and management communities[55]. Science-to-implementation efforts, which transfer science, data, technology, best practices, and other technical information to end-users who influence land management, are often needed to ensure that existing knowledge can be used to strengthen on-the-ground management[56].

Through our Science to Implementation Team, the IWJV has increased our capacity to support our partners in integrating science, data, technology, and other information into their work[57]. Our team will focus on understanding partner needs and applying our service-oriented approach to bridging science and implementation. Across IWJV priority ecosystems, our team will work with research partners to support managers with a variety of technical needs, including spatial targeting of sagebrush ecosystem management for wildlife habitat benefits and other values, outcome evaluation of management practices, and science synthesis and translation of management-relevant topics. Additionally, the Science to Implementation Team will develop and contribute to efforts that increase the technical transfer capacity and skills of others, such as through communities of practice, workshops, and training.

[53] See the Sage Capacity Team, [54] See the 2025 IWJV Implementation Plan Science to Implementation Chapter, [55] 2025 IWJV Implementation Plan Science to Implementation Chapter, [56] 2025 IWJV Implementation Plan Science to Implementation Chapter, [57] 2025 IWJV Implementation Plan Science to Implementation Chapter

4. Use compelling communications to advance proactive, collaborative sagebrush habitat conservation

The sagebrush conservation community needs powerful and creative forms of multimedia to share the interconnected nature of habitats, wildlife, and communities of the West with broad national audiences as well as hyper-local audiences. The IWJV communications program uses numerous strategic planning methods and tools to guide our effective outreach efforts, as detailed in the communications chapter of this implementation plan. In sagebrush communications, we strive to: (1) increase awareness about the BLM-IWJV partnership, (2) engage diverse partners in strategic storytelling about sagebrush, with a shared vision to restore and manage highly valued habitat, and 3) showcase proven models of partnership-driven conservation that benefit wildlife, communities, local economies, and partner goals.

5. Seek additional opportunities to further the IWJV approach

Active management efforts across sagebrush rangelands are extensive both in terms of (1) maintaining and growing the expanse of the existing habitat, and (2) defending against the numerous threats that continually arise and threaten sagebrush function and extent. There is a perpetual need to support efforts, new or old, to continually stay ahead of threats and maintain the future of this habitat. The IWJV's sagebrush program will continue to conduct scoping, work with partners, and support efforts that will further the IWJV approach to multi-benefit, cross-boundary conservation efforts across the sagebrush ecosystem.

Conservation Practices

Within the above conservation strategies and our vision for sagebrush ecosystems (Box 3), the IWJV supports our partners in implementing conservation actions that retain or restore resilient sagebrush habitat and incorporate habitat requirements for sagebrush obligate species into planning and management. Throughout the sagebrush biome, we support a suite of practices, where appropriate, that address the threats outlined above, including:

Addressing fire, fuels, and invasive annual grasses through…

- Herbicide applications and targeted grazing to treat invasive annual grasses in combination with appropriate revegetation approaches, especially in core sagebrush areas.
- Fuels reduction practices aimed at reducing fire intensity or severity or altering fire behavior, especially at the landscape scale. Practices include vegetation manipulation to reduce fine or canopy fuels, such as invasive annual grass treatments, targeted grazing, and targeted conifer removal, with emphasis on practices that have co-benefits for sagebrush plant communities and wildlife.
- Fuel breaks to improve firefighter safety and help protect human communities and intact sagebrush habitats through vegetation removal where appropriate.
- Restoration of native plant communities, especially when recovery is expected to be limited (e.g., postfire), through seeding or planting of genetically appropriate native grasses, forbs, and sagebrush species. Limited use of non-native species to achieve site stabilization or control invasive species where appropriate, with restoration of native species as a long-term priority.

Restoring and retaining riparian and wet meadow habitats using…

- Low-tech process-based restoration practices aimed at addressing riparian and wet meadow impairments like floodplain disconnection and channel incision by mimicking and promoting natural processes. Hand-built structures such as beaver dam analogs, post-assisted log structures, and Zeedyk rock and wood structures are examples. Appropriate structure maintenance and grazing management post-implementation.
- Beaver reintroduction and management to restore or retain ecosystem processes where appropriate.
- Grazing management practices that control the duration, timing, and intensity of grazing to promote healthy riparian and meadow vegetation. Examples of such practices could include fencing, water development, and herding.

Removing expanding conifers through…

- Conifer removal treatments targeted at improving sage-grouse and sagebrush habitat, such as hand cutting in Phase I or II woodlands with sagebrush understories and adjacent to intact habitats. Mastication (i.e., shredding, chipping) and other forms of removal with machinery on a more limited basis where appropriate and when precautions to mitigate increases in annual grasses from ground disturbance are included. Reestablishment of native understory vegetation where needed.
- Prescribed fire as a tool for removing expanding conifers in areas with relatively short historical fire return intervals (<50 years), intact sagebrush plant communities, and minimal invasive annual grasses (e.g., high-elevation, moist, mountain big sagebrush and mountain shrub plant communities). Application of this tool only during cool and low wind days and with as-needed mitigation to offset potential increases in invasive annual grasses postfire.

Supporting outcome-based grazing using…

- Flexible grazing authorizations aimed at allowing operators to better respond to environmental and operational conditions within BLM allotments.
- Monitoring and outcome evaluations to assess the efficacy of outcome-based grazing across a suite of wildlife and vegetation metrics.

Integrating strategies and practices through…

- Spatial targeting of treatments, especially to balance benefits to birds and other wildlife with ecological, social, cultural, and economic objectives. Relevance to people is an important emphasis for our work.
- Leveraging big game migration corridor conservation to benefit sagebrush obligate bird habitat.

Success in the Sage

The sagebrush biome, although a vast and inspiring feature of western North America, is facing its greatest threats ever. Collaboration and partnerships will be the mechanisms that retain this amazing biome for future generations to live in and enjoy and for wildlife populations to thrive in. This work will also maintain the irreplaceable ecosystem services provided by healthy and expansive sagebrush habitats. Numerous partners are coming together to implement an "all lands all hands" approach to manage, conserve, and restore sagebrush habitats. Success for the IWJV will be measured by leadership efforts and support to our partners that work day in and day out to sustain the West's sagebrush biome. Through assisting partners to build capacity to assist with innovative, habitat enhancement, we may influence the pace and scale of sagebrush management and conservation. Through strategic communications, there may be an increased acceptance of active management and partnership efforts. Ultimately, as a partner-driven wildlife habitat organization, our success will happen through partnerships and innovative approaches that conserve and restore the habitats of sagebrush birds and other sagebrush obligate species.

CHAPTER SEVEN:

Forest Ecosystems

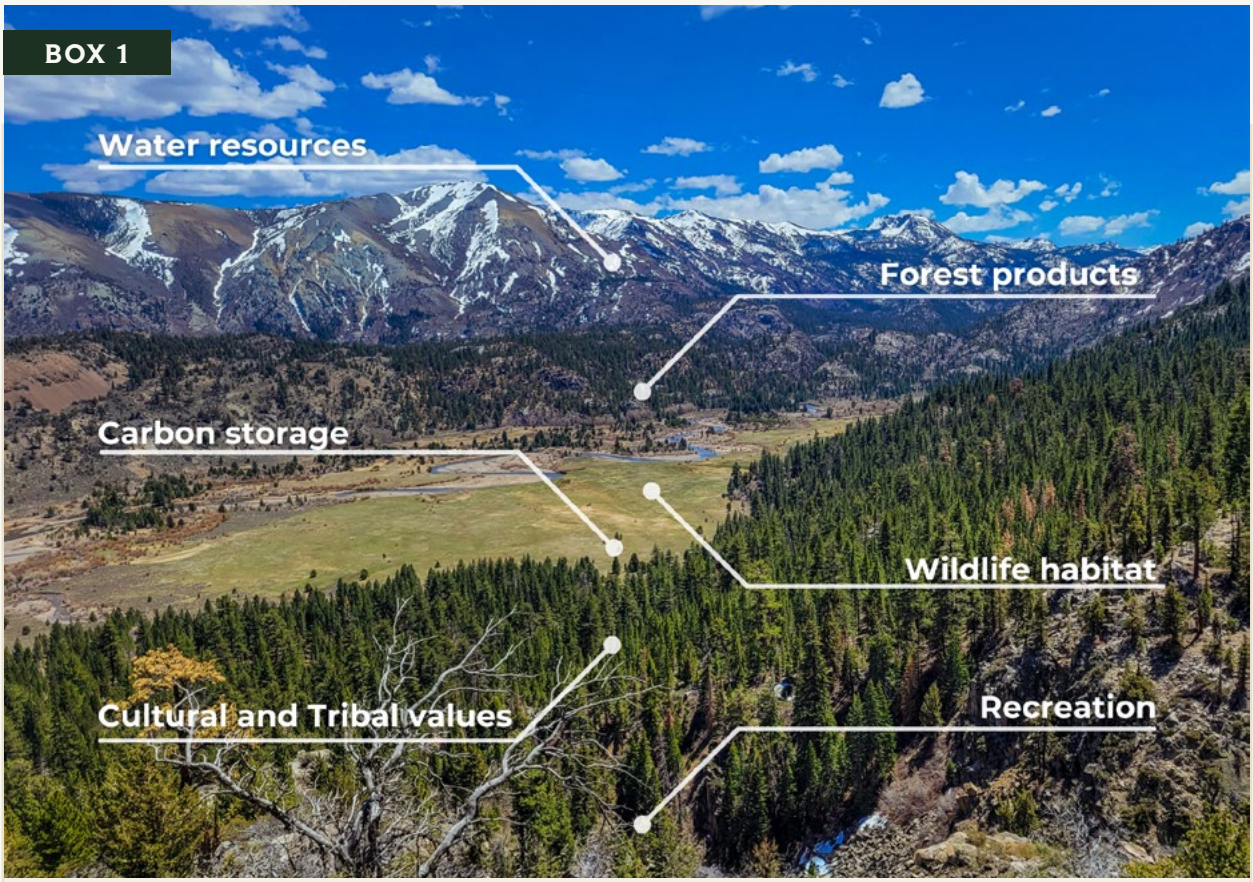
Introduction

Forests are some of the most iconic ecosystems of the West, known for their vastness, wildlife habitats, recreational opportunities, ecosystem services, and economic resources (Box 1). Increasingly, forests are also becoming known for their large and intense wildfires. Although fire is a natural and necessary component of western forest ecosystems, concern is rising about how changing fire regimes may threaten forests and those who rely on them, from birds to people. Because of emerging information highlighting declining forest birds (Box 2)[1], increasingly large and severe wildfires[2], and growing opportunities for active forest management across land ownership boundaries[3], western forests are emerging as a new priority habitat for the IWJV.

In this exciting new area of work, the IWJV will apply our durable and strategic approach to collaborative conservation that focuses on building partnerships, growing capacity, bridging science and implementation, and engaging in innovative communications efforts[4]. We recognize that many agencies, organizations, collaboratives, and partnerships already work in forest ecosystems. As such, our initial focus in western forests will be to identify opportunities for collaborative conservation that integrate wildfire risk reduction and bird habitat conservation, restore appropriate fire to the landscape, strengthen forest climate resilience, and prevent the expansion of invasive weeds (Box 3).

[1] Rosenberg et al. 2019, North American Bird Conservation Initiative 2022, Stephens et al. 2022, [2] Parks et al. 2023, [3] USFS Wildfire Crisis Strategy, [4] See the IWJV Strategic Plan and appropriate chapters of the 2025 Implementation Plan

BOX 1



What Do Forests Provide?

Water resources
In the western United States, forests contribute about 65 percent of water yield from about 23 percent of the land area[1]. Additionally, their soils act as filters, ensuring water quality for downstream users.

Carbon storage
Approximately 69 percent of the carbon in western ecosystems is stored in forests[2], providing resilient, long-term carbon storage.

Cultural and Tribal values
Indigenous peoples have had and still have relationships with forest plants, wildlife, and other beings since time immemorial. These elements of healthy forests are important for food, medicine, and other cultural purposes[3].

Forest products
Most Americans use wood products daily—from construction materials to furniture to firewood—equalling about 640 pounds of wood per person per year[4]. Non-timber forest products such as mushrooms, berries, and pine nuts are important commercially and for individual use.

Wildlife habitat
Western forests provide habitat for a suite of wildlife species, many of which are forest obligates. These include grizzly bears, lynx, deer, elk, and a plethora of bird species[5].

Recreation
Forests are used for recreation by many who enjoy hiking, backpacking, hunting, fishing, rafting, biking, wildlife watching, foraging, and more.

[1] Forest Atlas of the United States, [2] Zhu and Reed 2012, [3] Kimmerer 2015, [4] Forest Atlas of the United States, Chamberlain et al. 2018. [5] See Box 2.

BOX 2

Declining Forest Birds

The abundance of birds that breed in western forests has declined by 30 percent since 1970[1], likely due to widespread changes in forest structure, composition, and disturbance regimes.

A. The Lewis's Woodpecker (Melanerpes lewis) breeds in open ponderosa pine and recently burned forests that contain many snags. Photo: Mick Thompson.

B. The Pinyon Jay (Gymnorhinus cyanocephalus) is an iconic habitant of pinyon-juniper woodlands, congregating in large flocks and moving substantial distances within home ranges. Photo: Trish Gussler.

C. The Cassin's Finch (Haemorhous cassinii) breeds in the conifer forest of the western U.S., where males are known by their characteristic pink crown feathers. Photo: Tom Petit.

D. The Grace's Warbler (Setophaga graciae), like many, is a lover of the Southwest's mature pine forests, where it searches upper branches for insects. Photo: Tom Benson.

[1] Rosenberg et al. 2019

BOX 3

The IWJV Western Forest Toolbox

Priority Western Forest Ecosystems

Known for their diversity, forests within the IWJV boundary vary from lower-elevation, dry pinyon-juniper woodlands to high-elevation whitebark pine forests, with many unique forest types in between (Boxes 4 and 5). Forest types differ dramatically in their climate, species compositions, disturbance dynamics, and threats, and thus in their management needs. Given such diversity, the IWJV must prioritize our investments in forest ecosystems. We have identified dry forests and woodlands as priorities for early engagement because of their risk of catastrophic wildfire, declining bird species, important wildlife habitat, proximity to human communities, and extent within the IWJV boundary. We see opportunities in these forest types to support, expand, and build partnerships for collaborative conservation. In addition to these focal forest types, we're scoping opportunities in biodiversity hotspots, like aspen stands and riparian forests, which cover relatively small areas but provide outsized habitat benefits (Box 5).

We define dry forests and woodlands as dry, frequent-fire forests and pinyon-juniper woodlands. In dry, frequent-fire forests, evidence that active management can prepare forests for fire and improve ecological resilience—the ability of an ecosystem to maintain its ecological functions when experiencing disturbance—to climate change after over a century of fire suppression is a strong impetus for our focus[5]. Work in pinyon-juniper woodland ecosystems is a priority because of the steep decline of the charismatic pinyon-juniper obligate the Pinyon Jay (*Gymnorhinus cyanocephalus*; Box 6), the vulnerability of this ecosystem to catastrophic wildfire and changing climate, and growing interest among our partners to work together to address threats to this vast habitat[6]. Although common themes transcend each forest type, such as climate change and changes in forest structure, we address ecological differences between forest types below, as they are relevant to varying conservation approaches.

[5] Hagmann et al. 2021, Prichard et al. 2021, [6] Somershoe et al. 2020, Shriver et al. 2022, Redmond et al. 2023

Dry, Frequent-Fire Forests

Dry, frequent-fire forests are dominated by fire-tolerant tree species in dry settings, such as ponderosa pine (*Pinus ponderosa*) and sugar pine (*Pinus lambertiana*), and to a lesser degree, Douglas fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*)[7]. Several continentally important birds are associated with these habitats, including Cassin's Finch (*Haemorhous cassinii*), Lewis's Woodpecker (Melanerpes lewis), and Grace's Warbler (*Setophaga graciae*; Box 2)[8]. Historically, dry, frequent-fire forests primarily experienced low to moderate severity fire often, although fire return intervals varied[9]. Ignitions were caused by lightning, and—before Euro-American colonization—fires were used as a management practice by Indigenous peoples. Drought, insects, and pathogens also played a role in structuring dry, frequent-fire forests[11]. As a result of these disturbances, forests contained complex mosaics of fire-resistant species; large, old, fire- and drought-resistant trees were interspersed with non-forest openings. When low-severity fires were frequent, stand-replacing fires were limited[12]. This heterogeneity provided resistance to severe wildfires and created diverse wildlife habitat.

As a result of fire suppression, prohibition of Indigenous burning, historical management, and climate change, forest structure and function have changed in dry, frequent-fire forests, ultimately increasing high severity fire and reducing drought and wildfire resilience[13]. Restoring resilience to these forests requires active management and the return of appropriate fire to the landscape[14]. Research shows that fuels treatments can reduce the risk of catastrophic wildfires[15]. Bird habitat can also benefit from fuels reduction and forest restoration treatments[16] and is a priority for our work in this area. However, increasing the pace and scale of treatments will be necessary to achieve these goals at the landscape scale.

Pinyon-Juniper Woodlands

Across the Intermountain West, low mountains, foothills, and desert landscapes are blanketed by pinyon-juniper woodlands. Pinyon (*Pinus edulis and Pinus monophylla*) and juniper (*Juniperus spp.*) dominate these woodlands, which cover more than 100 million acres in total[17], with over 45 million acres within the IWJV boundary (Box 4). In addition to the Pinyon Jay, continentally important birds associated with these habitats include Virginia's Warbler (*Leiothlypis virginiae*) and Gray Vireo (*Vireo vicinior)*[18]. Although IWJV invests in the targeted removal of pinyon and juniper trees from sagebrush ecosystems for the benefit of sage-grouse[19], our Western Forests program focuses on the threats to and values of pinyon-juniper

Continued on next page →

[7] Dry conifer forests are defined in various ways throughout the literature. We distinguished dry, frequent-fire forests as a subset of dry conifer forests in order to emphasize the well-documented importance of frequent low to moderate severity fire in maintaining fire and drought resilience in these systems, especially in contrast to the more varied fire regimes in pinyon-juniper woodlands. See Taylor and Skinner 1998, Heyerdahl et al. 2001, Hessburg et al. 2005, Falk et al. 2011, Hagmann et al. 2021, and Parks et al. 2023, [8] Partners in Flight 2016, [9] Hessberg et al. 2005, [10] Kimmerer and Lake 2001, Taylor et al. 2016, Long et al. 2021, [11] Dale et al. 2001, Fettig et al. 2007, [12] Churchill et al. 2017, Hagmann et al. 2021, [13] Hagmann et al. 2021, [14] Hagmann et al. 2021, Prichard et al. 2021, [15] Reinhardt et al. 2008, North et al. 2012, Prichard et al. 2020, Prichard et al. 2021, [16] Cahall et al. 2013, Stephens et al. 2019, Latif et al. 2020, Latif et al. 2022, Saab et al. 2022, [17] Romme et al. 2009, [18] Partners in Flight 2016, [19] 2025 IWJV Implementation Plan Sagebrush Ecosystems Chapter

woodland ecosystems in and of themselves. Additionally, this work addresses the ecotone between sagebrush or grassland and pinyon-juniper woodlands because of the opportunity to develop and foster partnerships working across entire landscapes for multiple values and habitat objectives.

Historical fire regimes in pinyon-juniper woodlands varied substantially. Some areas where fine fuels were limited often experienced small, infrequent, high severity, stand-replacing fires[20]. For stand-replacing fires, although little information exists, fire rotations are estimated to reach 400 years[21]. In pinyon-juniper savannas and the ecotones with ponderosa pine forests and sagebrush steppe—where grasses and thus fine fuels are more prevalent—researchers have documented low severity fire[22]. In some regions, more frequent fire in adjacent sagebrush steppe may have prevented juniper expansion into sagebrush ecosystems[23]. Additionally, Indigenous fire management played a role in shaping pinyon-juniper woodlands[24]. Less is known about historical fire regimes in pinyon-juniper woodlands compared to other ecosystems[25]; thus, caution is needed when considering appropriate management actions.

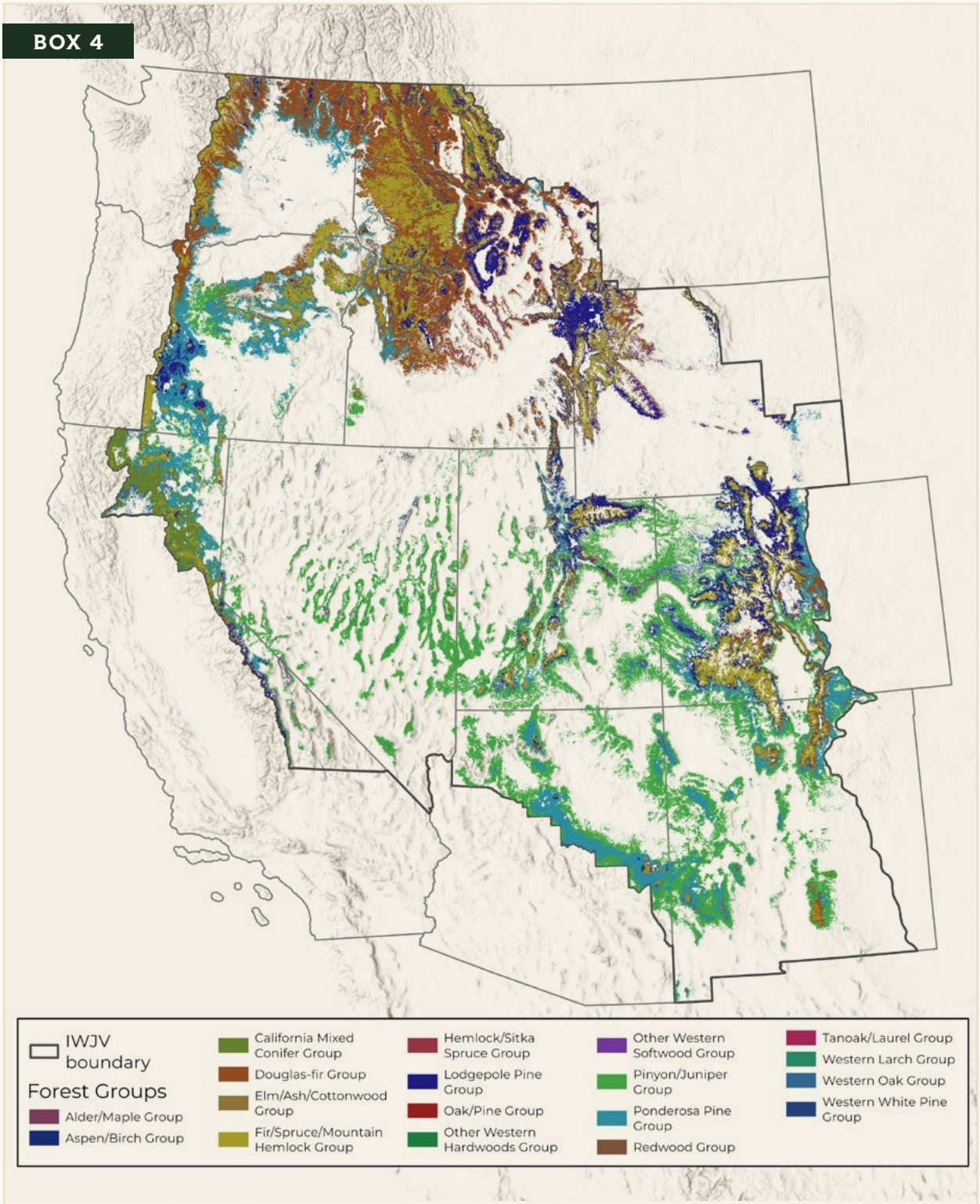
Drought mortality, bark beetle outbreaks, and disease dynamics also historically played a role in structuring woodlands[26], although presently, climate change has exacerbated their effects on some species and in some geographies.

Pinyon-juniper woodlands support a diverse suite of plants and wildlife species, including the imperiled Pinyon Jay. Additionally, they provide opportunities for recreation and solitude and play a central role in Tribal and rural culture and livelihoods. Pinyon-juniper ecosystems are fundamental to the cultural identities, ceremonies, and traditional practices of Indigenous peoples across the region, many of whom are leaders in conserving these woodlands. Yet, despite their ecological and cultural importance; recent mortality due to wildfires, drought, and insect and disease outbreaks; and the decline of the Pinyon Jay; pinyon-juniper woodlands have received less management focus than other dry conifer forest types. Partnerships focused on collaborative conservation for climate resilience, woodland health, and wildlife habitat are emerging to address this management gap.

Credit: U.S. Forest Service, Southwestern Region, Kaibab National Forest.

[20] Baker and Shinneman 2004, Romme et al. 2009, [21] Baker and Shinneman 2004, Floyd et al. 2004, Bauer and Weisberg 2009, [22] Allen 1989, Miller and Rose 1999, Margolis 2013, [23] Miller and Rose 1999, Miller and Tausch 2002, Miller et al. 2003, [24] Roos et al. 2022, [25] Baker and Shinneman 2004, [26] Miller et al. 2019

BOX 4



Forest Groups within the IWJV Boundary

Forest Group data is from the National Forest Types Dataset. See Appendix 1 for acreage and percent of the IWJV geography for each forest type.

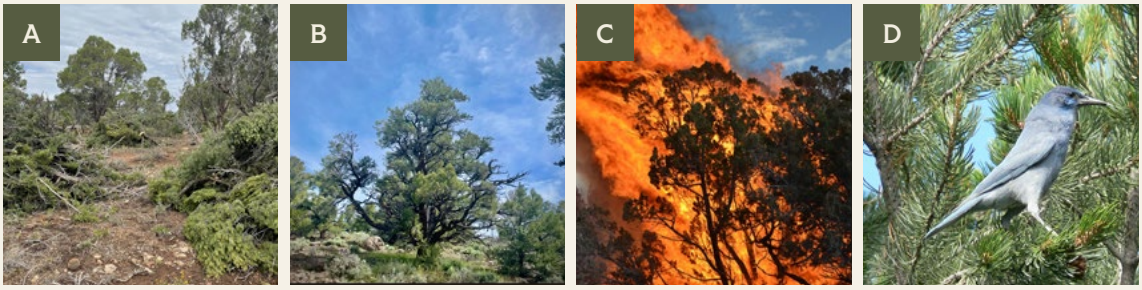
BOX 5

Priority Forest Types

Dry, frequent-fire forests

A. Open ponderosa pine forest, Lolo National Forest, Montana. **B.** Flying J prescribed fire, Kaibab National Forest, Arizona. Photo: Kaibab National Forest. **C.** Pile burning after thinning for fuels reduction in the Elko Front Wildfire Crisis Landscape, Humboldt-Toiyabe National Forest, Nevada. **D.** Beetle kill in ponderosa pine and Douglas fir forest in the Sierra Front Wildfire Crisis Landscape, Humboldt-Toiyabe National Forest, Nevada.

Pinyon-juniper woodlands

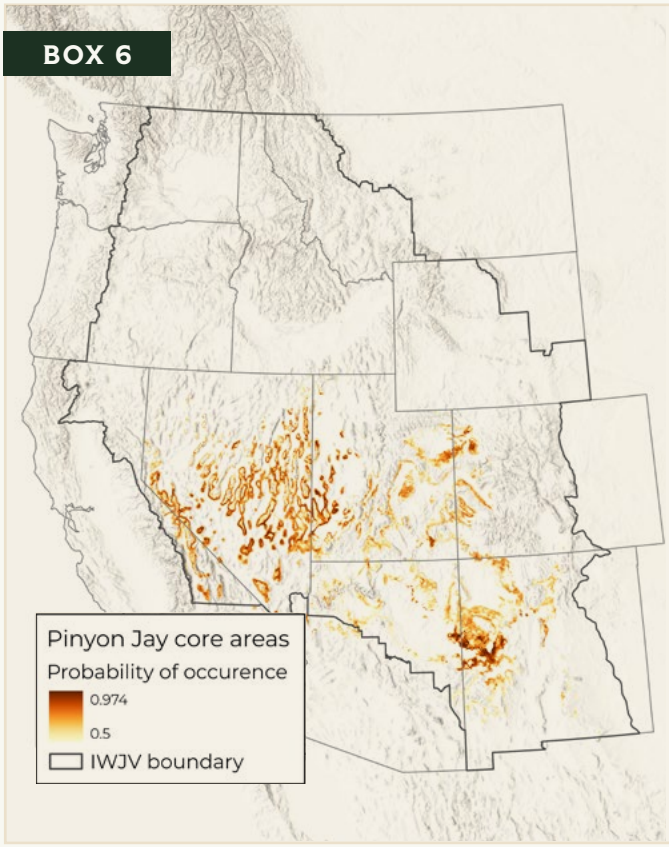


A. Pinyon-juniper woodland in southern Colorado after silvicultural treatments aimed at improving woodland resilience and reducing fire risk, BLM Tres Rios Field Office, Colorado. Photo: Ian Barrett, BLM Colorado State Office. **B.** Persistent pinyon-juniper woodlands with centuries-old single-leaf pinyon (*Pinus monophylla*) tree, Sierra Front Wildfire Crisis Landscape, Humboldt-Toiyabe National Forest, California. **C.** Bert Fire burns in pinyon-juniper woodlands, Kaibab National Forest, Arizona. Photo: Kaibab National Forest. **D.** Pinyon Jay (*Gymnorhinus cyanocephalus*) in front of a pinyon pine. Photo: Sally King.

Biodiversity hotspots

A. Yellow-bellied Sapsuckers (*Sphyrapicus varius*) rely on live trees like this aspen for sapwells. Photo: Keith Williams. **B.** Fire-induced aspen ecosystems are rich in biodiversity because of the varied habitats they provide. Photo: Coconino National Forest. **C.** Cottonwood galleries, like this one along Deep Creek in the Curlew National Grassland, provide habitat features not found in adjacent drylands. **D.** Meadows and riparian areas within forested ecosystems, like Zedd's Meadow in the Fishlake National Forest, Utah, provide outsized wildlife benefits. Photo: U.S. Forest Service.

BOX 6



Core areas for Pinyon Jays (*Gymnorhinus cyanocephalus*) within the IWJV boundary

Modeled probability of occurrence of Pinyon Jays is shown within the IWJV boundary. These data emphasize areas with a high likelihood of Pinyon Jay presence or likely hotspots for this species. Only areas with >50 percent probability of occurrence are shown. Data was provided by Jason Tack (USFWS) and is currently in preparation for publication.

Threats to Dry Conifer Forests & Woodlands

Western forests demand more and more attention as they go up in flames, impacting wildlife habitat, ecosystem services, and other values. Although fire has always been an integral part of western landscapes, recent years have seen more frequent and severe fires due to fire suppression and prohibition of Indigenous burning, changing forest structure, climate change, historical land management, and invasive species. Beyond fire-related mortality, climate change has exacerbated drought, insect, and disease outbreaks for some species, contributing to additional mortality. As disturbance occurs, some areas experience limited regeneration of desirable forest species while invasive species spread. In the wildland-urban interface (WUI), development can lead to habitat loss and fragmentation, and managers face unique challenges to keep people and infrastructure safe. In this section, we address these topics across forest types and discuss how they inform management approaches in dry, frequent-fire forests and pinyon-juniper woodlands. We acknowledge that many of these threats are complex and interrelated but address them separately to discuss the nuances of each.

Landscape Changes

In an era of rapid ecosystem change, forests of the Intermountain West face increasing climate variability and extremes, challenging their resilience and managers' ability to respond. Increased temperatures, greater variation in precipitation, lower snowpack, a greater number of mega droughts lasting more than a decade, and more extreme precipitation events are expected in the future [27, 28]. Drought is expected to be particularly persistent in the Southwest[29]. Wildfire area in the West is estimated to have already doubled and is only expected to increase[30]. Species and forest type migration, adaptation, and extirpation are also predicted to occur [31]. These changes interact with or exacerbate the threats discussed below and must be explicitly addressed in the planning and implementation of forest management so that management goals are compatible with future conditions.

Fire Suppression, Changes in Forest Structure, & Increasing Wildfire

In recent years, fire activity has increased in the West as a result of historical and contemporary fire suppression, land management, climate, and climate change. Contemporary fires cover more area, occur throughout a longer fire season, and are more severe than fires of the past[32]. In dry, frequent-fire forests, after colonization by Euro-Americans, fire suppression and prohibition of Indigenous burning were widespread in many parts of the West[33]. Additionally, favorable climate conditions promoted tree establishment and growth, but because fire did not remove small trees or other biomass, forest density increased[34]. Dry, frequent-fire forests were historically low-density with widely spaced large trees and low and patchy surface fuels, which made them resistant and resilient to wildfire. Today, dense forests contain a greater number of small trees and more surface and canopy fuels, which are prone to high severity, stand-replacing fire[35].

In pinyon-juniper woodlands between 1984 and 2013, the total area burned by wildfire increased, and fire rotations decreased. As a result, in some regions, the percentage of area burned in pinyon-juniper woodlands is higher than the percentage burned in other land cover types[36]. Although the causes of increased fire activity in pinyon-juniper woodlands during this period are not well understood, researchers believe that the continuity of canopy and fine fuels as a result of high tree density, invasive annual grasses, and climate change could be contributing factors[37]. Research has documented widespread, although variable, increases in tree density through infill of existing woodlands[38]. The causes of infill are not well understood[39], but they likely result from a combination of tree population dynamics, climate change, recovery from historical management, and enhanced atmospheric carbon dioxide[40]. These trends have raised concerns about the vulnerability of woodlands to wildfire and the potential for loss of wildlife habitat, recreational opportunities, Tribal and cultural values, and economic opportunities, especially in proximity to human communities.

[27] Rupp et al. 2016, Vose et al. 2017, [28] Easterling et al. 2017, Mote et al. 2018, [29] Wehner et al. 2017, [30] Abatzoglou et al. 2016, Abatzoglou and Parks 2016, Abatzoglou et al. 2021, [31] Aitken et al. 2008, [32] Abatzoglou and Kolden 2013, Abatzoglou and Parks 2016, Parks et al. 2023, [33] Parks et al. 2015, [34] Hessburg et al. 2005, [35] Taylor and Skinner 1998, Heyerdahl et al. 2001, Hessburg et al. 2005, Falk et al. 2011, Hagmann et al. 2021, [36] Board et al. 2018, [37] Board et al. 2018, [38] Miller et al. 2019, Filippelli et al. 2020, [39] Romme et al. 2009, [40] Romme et al. 2009, Shriver et al. 2024

Tree Mortality

Local to regional forest mortality due to drought, insects, and disease is causing increasing concern because it affects a broad range of forest types. Although these disturbances have historically driven forest stand and ecosystem dynamics, climate change is expected to exacerbate the scale, severity, and impacts of such disturbances and their interactions with each other[41]. Already, widespread forest mortality at the magnitude of millions of acres is occurring. As a result of climate-induced drought and insect and disease outbreaks, an estimated 350 million two-needle pinyons in the Colorado Plateau were killed in the early 2000s[42]. Mountain pine beetle outbreaks have affected millions of acres across multiple forest types from Alaska to Mexico, with higher potential for even more outbreaks over the next century, especially as drought exacerbates their effects[43]. High tree density appears to exacerbate mortality under some circumstances[44]. Predicting mortality and subsequent effects in a dynamic and warming climate will prove challenging[45]. Developing management strategies to bolster resilience to intensifying disturbances will be important to achieving forest and woodland management goals into the future.

Limited Regeneration

Limited regeneration after mortality-causing disturbance, like wildfire or drought, may lead to ecosystem type conversions, particularly under the warmest and driest conditions. Regeneration after disturbances is an important component of natural forest dynamics and contributes to the resilience of forests to their disturbance regimes. In dry forests and woodlands, regeneration after disturbance is expected to be slow, often timed with periods of mild and wet weather[46]. However, in some forest types, natural regeneration post-disturbance in a climate change- and human-affected era has been even more limited than expected. Lack of regeneration has occurred locally to regionally in dry, frequent-fire forests and pinyon-juniper woodlands, likely due to naturally slow establishment coupled with climate change effects on seedling establishment and reduced seed sources due to large and severe wildfires[47]. As such, the resilience of ecosystems to disturbance and climate change itself may have diminished. When stand-replacing fires or other disturbances occur, ecosystem type conversions could result in areas where regeneration does not occur, with potentially large-scale implications for ecosystem services like carbon sequestration and loss of forest aesthetics and values[48]. Additionally, Pinyon Jays and other birds are important in dispersing seeds for pinyon species[49], and the effect of their decline on regeneration is unknown.

[41] Adams et al. 2009, Bentz et al. 2010, McDowell et al. 2016, Vose et al. 2018, Wasserman and Mueller 2023 (Fig.3), [42] Adams et al. 2009, Meddens et al. 2014, [43] Wulder et al. 2006, Bentz et al. 2009, Bentz et al. 2010, Kolb et al. 2016, [44] Flake and Weisberg 2018, Restaino et al. 2019, Shriver et al. 2022, [45] Clark et al. 2016, [46] White 1985, League and Veblen 2006, Redmond and Barger 2013, Redmond et al. 2018, [47] Stevens-Runman et al. 2017, Davis et al. 2019, Shriver et al. 2022, Davis et al. 2023, Phillips et al. 2024, [48] Coop et al. 2015, Tepley et al. 2017, Walker et al. 2018, Coop et al. 2020, [49] Pesendorfer et al. 2016

Invasive Weeds

Across the West, invasive weeds are growing their footprint. As weeds invade, they threaten native biodiversity by displacing native understory vegetation, degrading wildlife habitat, and ultimately altering ecosystem processes and functions[50]. There has been substantial focus on this issue in western rangelands, with growing momentum to defend and grow weed-free core rangeland areas through management actions[51]. However, in forests, invasive weeds have received less attention[52]. Although forests are thought to be more resistant to shade-intolerant invasive weeds, future climate-related disturbances and lack of tree regeneration may increase available habitat for invasive weeds, especially after forest die-offs[53]. Additionally, disturbance caused by management activities could also increase invasive weed susceptibility[54]. Concern about postfire increases in invasive weeds, such as invasive annual grasses commonly seen in rangeland systems, is mounting[55]. For quality habitat for birds and other wildlife, as well as ecosystem function, addressing invasive weeds is a critical component of forest and woodland management.

Land Use Change & Development

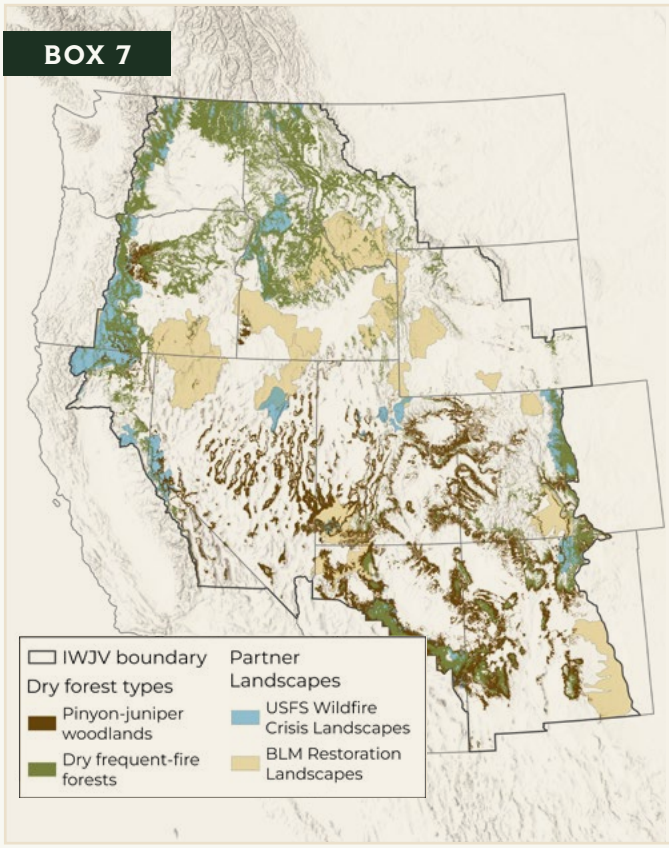
Land use trends in the Intermountain West have created new challenges for managing lands near human communities. The WUI is the area where human development intersects with or is near large areas of wildland vegetation[56]. As more people live, work, and recreate in the WUI, the unique resource management challenges in this area need additional attention. States in the Intermountain West have some of the highest proportion of houses within the WUI: between 40 and 80 percent[57]. These states also have some of the highest population growth in the WUI area between 1990 and 2020, with increases between 25 and 85 percent[58]. Beyond higher wildfire risk to human communities due to proximity, the WUI faces higher human-caused ignition rates, challenges to wildfire suppression, habitat loss and fragmentation, high concentrations of invasive species, and other concerns relevant to human communities[59]. Land managers must contend with the complexities of management in the WUI, searching for conservation outcomes that balance the needs of ecosystems, wildlife, and people.

[50] Litt et al. 2013, Coates et al. 2016, Chambers et al. 2017, Fusco et al. 2019, [51] Maestas et al. 2022, [52] Kerns et al. 2020, [53] Abatzoglou and Kolden 2011, Peeler et al. 2018, Kerns et al. 2020, [54] Kerns et al. 2020, [55] Peeler et al. 2018, [56] Mockrin et al. 2023, [57] Volker et al. 2018, Mockrin et al. 2023, [58] Volker et al. 2018, Mockrin et al. 2023, [59] Radeloff et al. 2005, Syphard et al. 2007, York et al. 2011, Hamilton et al. 2016

Priority Geographies

As IWJV's priority forest types cover millions of acres within our geography, we must prioritize our investments. Within the priority ecosystems outlined above, we will prioritize work where existing partnerships are strong and durable, established partner priorities exist, and the potential to improve bird habitat is high. Within dry, frequent-fire forests, early focus will be on areas partners have already identified as important for forest restoration, management, and wildfire risk reduction. Initial work may prioritize BLM Restoration Landscape[60], USFS Wildfire Crisis Strategy Landscapes[61], and areas identified in state or Tribal forest plans or other collaborative plans (Box 7). In pinyon-juniper woodlands, priority values that will drive the geographies we work in include Pinyon Jay core habitat, importance to Tribal and local communities, wildfire risk, and potential for woodland resilience and health improvements. Emerging partnerships focused on pinyon-juniper woodlands will also likely drive investment. Additionally, the IWJV will apply our common ground partnership approach in geographies where Pinyon Jay and woodland priorities overlap with sage-grouse and sagebrush ecosystem priorities because of the opportunity for cross-value and cross-boundary landscape-scale planning, prioritization, and conservation success.

BOX 7



Partner priority landscapes within the IWJV boundary

Polygons show USFS Wildfire Crisis and BLM Restoration Landscapes. Dry, frequent-fire forest data were derived following the methods in Parks et al. 2023 using the LANDFIRE Biophysical Settings dataset and clipped to the IWJV boundary. Pinyon-juniper woodlands were identified using the National Forest Types Dataset and clipped to the IWJV boundary.

[60] BLM Restoration Landscapes, [61] USFS Wildfire Crisis Strategy Landscapes

Conservation Strategies & Practices

IWJV's conservation strategies and practices in western forests serve the vision for our work in this habitat: to integrate wildfire risk reduction and bird habitat conservation, restore appropriate fire to the landscape, strengthen forest climate resilience, and prevent the expansion of invasive weeds (Box 3). These strategies leverage our IWJV approach—building partnerships, growing capacity, bridging science and implementation, and engaging in innovative communications—toward this vision. Specifically, the IWJV's work in western forests supports our partners in integrating current knowledge, science, and data on bird and wildlife effects of forest management into their work; growing capacity to implement forest management practices that have long-term habitat benefits to birds and other wildlife; and communicating the outcomes and needs of this work to relevant audiences.

Conservation Strategies

We use the following conservation strategies to guide our investments of staff time and resources across spatial scales, disciplines, management entities, and topics:

1. Develop partnerships across professional and jurisdictional boundaries

Building relationships with partners in forest ecosystems continues to be a priority for the IWJV. Through work prior to this Implementation Plan, we have developed strong foundations of new partnerships with researchers, state and federal agencies, Tribal Nations and entities, and others working in forest ecosystems. However, to achieve a vision of catalyzing collaborative conservation efforts that integrate bird conservation into forest management, our team will continue to build connections with partners across professional and jurisdictional boundaries. A primary focus of initial work will be on broadening our partnership to identify new and different stakeholders with common interests.

Additionally, the IWJV will work to connect groups across disparate professional communities with perceived tradeoffs among values or priorities. For example, the decline of the Pinyon Jay has led to concern that removing conifers expanding into sagebrush ecosystems to improve habitat for the sage grouse may have negative consequences for woodland-obligate Pinyon Jays. The IWJV will bring a neutral, science-driven perspective to such issues and leverage our partnership approach to identify common-ground solutions.

2. Facilitate science development to fill key knowledge gaps on forest management, bird habitat, and other ecosystem services

Forest managers working to integrate multiple values into their work, including wildlife habitat, rely on actionable and accessible information to inform prioritization and planning. In many forest ecosystems, a growing body of knowledge is available that can inform management and help agencies fulfill "best available science" mandates[62]. However, numerous knowledge gaps create barriers to achieving wildlife-focused management goals in our priority forest types (Box 8).

The IWJV has a track record of facilitating priority science development that informs wildlife conservation efforts[63]. Building on this experience, the IWJV will work with public, private, and Tribal partners to identify additional gaps in knowledge relating to bird and wildlife conservation within dry forest and woodland ecosystems that represent barriers to implementation success. Where important gaps in knowledge are identified within IWJV priority forest ecosystems and geographies, we will work with external science partners to catalyze, fund, develop, and communicate priority science. To support this work, we will continue to prioritize expanding our research partner network, including both Western scientists and Indigenous scientists or knowledge holders, where appropriate.

3. Facilitate the development of a pinyon-juniper woodland research and monitoring network

There is a growing need for information on the spatial extent and distribution of threats to pinyon-juniper woodlands and on management practices that can address these threats (Box 8). Managers and conservation partners are increasingly interested in managing for woodland health, fuels reduction, and wildlife habitat goals. However, a major barrier to action is a lack of robust information on the practices that can achieve such goals and where they might be appropriate at landscape scales. To address this knowledge gap, information is needed at the scale at which management occurs, across regions and ecosystems, and for multiple management approaches ranging from silvicultural treatments to pinyon-juniper removal to no treatment. Small-scale projects without coordination will fail to advance our knowledge of pinyon-juniper systems quickly enough and will risk duplication of efforts. Thus, a coordinated, transdisciplinary, cross-boundary approach that leverages ongoing research and management is needed to rapidly gain information on the spatial extent of pinyon-juniper values and threats and the management strategies needed to meet pinyon-juniper woodland ecosystem management goals.

The IWJV is well positioned to facilitate such an effort because of our robust and growing research and management network; partnership approach; track record in facilitating high-priority science; and reputation as a neutral, science-driven organization. Leveraging these attributes, we will work with key research and management partners to kickstart, fund, and coordinate a research and monitoring network to identify and fill key knowledge gaps for managers. Success for this long-term effort would be the development of spatially explicit management guidelines and appropriate, place-based strategies.

[62] Doremus et al. 2004, Wright 2010, Kitchell et al. 2015, [63] Donnelly et al. 2016, Donnelly et al. 2017, Jones et al. 2018, Donnelly et al. 2020, Donnelly et al. 2022, Kleinhesselink et al. 2023

4. Bridge science and implementation to ensure existing knowledge can be used to strengthen on-the-ground forest management

Bridging knowledge and action is often a challenge in conservation. Much existing science does not address the specific needs of managers[64]. Adoption of management-relevant information often lags behind its development[65]. Many institutional and capacity-related barriers to using this knowledge in land management decisions exist within research and management communities[66]. Science-to-implementation efforts, which transfer science, data, technology, best practices, and other technical information to end-users who influence land management, are often needed to ensure that existing knowledge can be used to strengthen on-the-ground forest management[67].

Through our Science to Implementation Team, the IWJV can support our partners in integrating science, data, technology, and other information into their work[68]. Our team will focus on understanding partner needs and applying our service-oriented approach to bridging science and implementation. Across IWJV priority forest types, our team will work with research partners to support managers with a variety of technical needs, including spatial targeting of forest and woodland management for wildlife habitat benefits and other values, outcome evaluation of management practices, and science synthesis and translation of management-relevant topics.

5. Increase community-based capacity to implement forest management with bird habitat benefits in priority ecosystems and geographies

As forest management activities focused on wildfire, fuels reduction, and ecosystem resilience scale up, successfully implementing strategic forest management and restoration will require additional capacity. Critical functions like partnership facilitation, bridging science and implementation, planning and implementing projects, monitoring and evaluating outcomes, engaging the public and citizen scientists, and more will fall short without additional people power connected to local communities.

The IWJV has a proven record of establishing and supporting critical community capacity for conservation[69] which we will apply to our emerging work in forest ecosystems. As we develop partnerships with state and federal agencies, Tribal Nations and entities, nonprofit organizations, universities, and others, we will seek out strategic opportunities to support capacity positions that meet the needs of our partners and fill capacity gaps that are difficult for other organizations to fill. Capacity gaps include coordinating across pinyon-juniper woodland management efforts, implementing public or private lands forest management focusing on bird habitat, or transferring a growing body of information on Pinyon Jays to managers.

[64] 2025 IWJV Implementation Plan Science to Implementation Chapter, [65] Olsen et al. 2024, [66] 2025 IWJV Implementation Plan Science to Implementation Chapter, [67] 2025 IWJV Implementation Plan Science to Implementation Chapter, Olsen et al. 2024, [68] 2025 IWJV Implementation Plan Science to Implementation Chapter, [69] See the Sage Capacity Team

6. Elevate forest management work at the nexus of wildlife conservation, forest health, climate resilience, and human livelihoods through strategic communications

Supporting our partners in highlighting innovative and successful conservation efforts through collaborative communications efforts is a strength of the IWJV[70]. Using a variety of communication tools and tactics, we will highlight conservation projects and management practices in western forests that reduce wildfire risk and benefit wildlife and people. In the early development of this programmatic area, our strategic communications will focus on promoting science-informed active management through storytelling that supports ongoing forest management efforts or catalyzes additional efforts. We will utilize our science-to-implementation and communications capacity to create external-facing communications campaigns, develop technical transfer products, and design targeted distribution strategies. To establish and expand the reach of our forest communications, we will leverage existing relationships with communications professionals at public, Tribal, and non-governmental organizations while seeking new partnerships with effective communicators and communication outlets relevant to our strategies. Our Communications Team will use caution when approaching controversial practices or decisions that may cause divides between our partners. Determining the IWJV's communications approach will include detailed planning, vetting, and collaborative production.

7. Seek additional opportunities to apply the IWJV approach to multi-benefit conservation efforts in forests

As our work in forest ecosystems grows, the IWJV will continue seeking additional opportunities for multi-benefit conservation wins in forest ecosystems. We strive to be nimble, relevant, and responsive by seeking opportunities to add value to our partners' work. Our initial priority will primarily be developing funding sources and refining our focus. As we see success in supporting partners in achieving forest management goals, the IWJV will seek additional partnership and funding opportunities that will allow us to expand our reach in western forests. Additionally, we will conduct internal scoping to identify potential new priority forest ecosystems, such as biodiversity hotspots like aspen and riparian forest ecosystems, and topics, like water and carbon implications of wildfire and forest management, which may help to catalyze additional forest bird habitat conservation.

[70] 2025 IWJV Implementation Plan Communications Chapter

Conservation Practices

Under the above conservation strategies and our vision for western forests (Box 3), we support a suite of conservation practices across spatial scales. Our work spans scales– from individual projects to watersheds to ecoregions–emphasizing efforts that integrate across spatial scales, disciplines, management entities, and threats. In forest ecosystems, we support a suite of practices, where appropriate, including:

Integrating wildlife habitat and fuels management through…

- Ecological forestry practices focused on restoring, mimicking, or maintaining ecological complexity, spatial heterogeneity, and natural processes.
- Fuels reduction practices that reduce fire intensity or severity where ecologically appropriate, especially at the landscape scale or with long-term habitat benefits to birds (e.g., thinning, removal of understory or midstory fuels).
- Spatial targeting of treatments, especially to balance costs and benefits to birds and other wildlife with other ecological, social, cultural, and economic objectives.
- Strategic conservation easements to protect wildlife and other ecological, cultural, and economic values, where appropriate.

Restoring appropriate fire to the landscape through…

- Prescribed fire and Indigenous or cultural burning in appropriate forest types.
- Appropriate silvicultural practices needed to prepare dry, frequent-fire forests for frequent low intensity fire.

Strengthening forest resilience through…

- Ecological forestry and fuels reduction practices, like those described above, that increase forest resilience to climate change effects, including drought, wildfire, and insect and disease outbreaks.
- Postfire rehabilitation, such as seeding or planting with native species, especially when native species have a low likelihood of regeneration postfire or post-disturbance.

Preventing expansion of invasive weeds through…

- Invasive species management as appropriate, especially postfire or post-treatment, including herbicide treatments, targeted grazing, and seeding or planting native species.
- Prioritization and planning of treatments to minimize the risk of invasive weeds (e.g., using methods that reduce disturbance in low resistance or resilience sites).

Success in Western Forests

In dry forests and woodlands, integrating wildfire risk reduction and bird habitat conservation, restoring appropriate fire to the landscape, strengthening forest climate resilience, and preventing the expansion of invasive weeds (Box 3) will not happen without partnerships. No single entity can meet these goals alone, necessitating an "all lands, all hands" approach. Under our efforts, we would consider success to be outcomes like:

- Through our science-to-implementation efforts, forest or woodland managers becoming better equipped with evidence-based approaches to forest management and explicitly considering wildlife habitat values in planning and implementation.
- Through our capacity building efforts, increasing the pace and scale of active forest management by expanding the workforce to deliver conservation.
- Through strategic communications, increasing acceptance of active management of western forests, including prescribed fire.

Ultimately, success will be the conservation and restoration of forest bird habitat through partnerships.

APPENDICES

Appendix 1. Area of Primary Forest Groups & Forest Types Within the IWJV Landscape

Forest Group	Area (acres)	Percent of IWJV Landscape
Pinyon/Juniper	45,132,489	9.4%
Fir/Spruce/Mountain Hemlock	31,137,759	6.5%
Douglas Fir	29,956,362	6.2%
Ponderosa Pine	24,315,870	5.1%
Lodgepole Pine	14,086,402	2.9%
Aspen/Birch	7,461,425	1.6%
Other Forests*	13,280,937	2.7%
All Forests	165,371,244	34.5%

*All forest types present within the IWJV boundary with less than 1% cover by area are included in Other Forests.

Priority Forest Type	Area (acres)	Percent of IWJV Landscape
Dry, frequent-fire conifer forests	48,862,371	10.2%
Pinyon-juniper woodlands	45,132,489	9.4%
All dry conifer forests	93,994,860	19.6%

Dry, frequent-fire forests are dominated by fire-tolerant tree species that evolved with high-frequency, low to moderate severity fire regimes, such as ponderosa pine (Pinus ponderosa), sugar pine (Pinus lambertiana), Douglas fir (Pseudotsuga menziesii), and western larch (Larix occidentalis) in dry settings. These area data were derived following the methods in Parks et al. 2023 using the LANDFIRE Biophysical Settings dataset and clipped to the IWJV boundary. Pinyon-juniper woodlands were identified using the National Forest Types Dataset and clipped to the IWJV boundary.

Conclusion

The 2025 IWJV's Implementation Plan will inform the daily work of the staff and ensure we stay true to our mission and core values while allowing appropriate flexibility to look for innovations and new opportunities to accelerate our work and the work of our partners.

The conservation strategies presented in this implementation plan are intended to provide pragmatic, evidence-based solutions to the Intermountain West's pressing challenges. The plan also provides partners with details about the IWJV's priorities and highlights collaboration and partnership opportunities. The implementation plan is a living document we will return to as needed to adapt to new challenges and opportunities.

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