



TO: Columbia River Gorge Commission

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DATE: June 8, 2021

RE: **Work Session*:** Vital Sign Indicators Program: Natural Resource and Climate Change Indicators Progress Report and Commission Discussion

Purpose

The purpose of this staff report is to share progress on natural resource and climate change Vital Sign Indicators since February 2021 when the Commission discussed the 2021 VSI Assessment and Work Plan. This report provides an overview of the indicator review process and rationale for the preliminary list of priority Vital Signs and potential indicators being considered. A summary table describing how the 2021 updated natural resource framework connects with the original 2009 Vital Sign Indicators is included as an attachment.

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I. Program Background

The Vital Sign Indicators (VSI) program evaluates the long-term health of scenic, natural, cultural, and recreation resources, and local economies, of the Columbia River Gorge National Scenic Area (CRGNSA). The Management Plan directs the Gorge Commission to design a monitoring and evaluation program to evaluate the effectiveness of the Management Plan in protecting these resources and supporting and protecting the economy (Part IV, Chapter 1: Gorge Commission Role). VSI program objectives include:

- Track the status and trends of protected resources over time to assess if we are achieving Management Plan goals.
- Use indicator data to guide adaptive management, including ongoing decision-making and future Management Plan review and revision.
- Build and strengthen partnerships with the four Columbia River treaty tribes and partner agencies, counties, and communities to leverage information and capacity toward shared management goals.
- Communicate our findings through accessible, interactive formats to raise awareness of the health of the National Scenic Area.

In 2007, the Gorge Commission, U.S. Forest Service, partner agencies, Gorge residents, and non-profit organizations began working on the VSI project as a community-driven planning initiative. Through a public process involving a Technical Advisory Team, a Community Advisory Team, the Gorge Commission Assessment Committee, and many partner agencies, 51 Vital Sign Indicators were created to assess the condition of scenic, natural, economic, cultural, and recreation resources in the National Scenic Area. In May 2009, the Commission prepared a “State of the Gorge” report that summarized data for 24 indicators with the goal of reporting on the remaining 27 indicators in the second phase of the project in 2011. Of the 24 indicators included in the 2009 report, only 5 indicators had data available “off the shelf”; 13 indicators required staff to perform extensive analysis on existing information to create useful measures; and 6 indicators required staff to develop data from scratch.

As a result of budget cuts and staff changes in 2010, the VSI project did not move forward as anticipated. The Gorge Commission now has dedicated funding and staff resources to work on VSI and is focused on a strategic and comprehensive update of all indicators in 2021-22. (See the VSI Assessment and 2021-2022 Work Plan presented at the February 2021 Commission meeting for details on the overall update approach, as well as key management questions and potential Vital Sign topics for all resource areas.)

We recognize the tremendous time and effort of those who contributed to the 2009 VSI project and seek to carry forward the goals of the original effort, using their effort as a foundation while making the changes necessary based on what we have learned in the last decade. Climate change, for example, was not mentioned in the 2009 Vital Sign Indicators effort. The natural resource and climate change update methodology that follows incorporates current information on monitoring programs in the region, datasets, and revised Gorge 2020 Management Plan policies.

II. Methodology for Natural Resource and Climate Change Indicator Review Process

For the first phase of the VSI update in 2021, the Commission approved starting with natural resource and climate indicators, given the interconnected and foundational nature of these topics for all other protected resources and economies in the CRGNSA. This timing also provided the opportunity to integrate climate vulnerability assessment information from the Climate Change Action Plan (CCAP) effort with the indicator development process. (See the Climate Change Action Plan Progress Report from June 8, 2021 for details on climate vulnerability rankings for different resources in the CRGNSA.)

A brief explanation of terms in this section is noted here:

Management Plan Goal: A goal included in the text of the Columbia River Gorge National Scenic Area Management Plan.

Key Management Question: A priority question or information need identified by the Gorge Commission and U.S. Forest Service to support implementing the Management Plan.

Vital Sign: The topic for a high-level indicator. Represents important components of protected resources that guide assessment of progress toward Management Plan goals (e.g., wetlands, scenic views, and economic vitality). Each Vital Sign is represented by one or more indicators.

Indicator: A short description of what is being measured with a reference to measurement method or unit of measurement (e.g., stream temperature).

Target/Outcome: Desired condition for a given resource that demonstrates achievement of Management Plan goals.

Possible Management or Policy Action: Different courses of action the Commission and Forest Service could take based on VSI findings.

Main steps of the indicator review process:

- Identify **key management questions:** Building upon the 2009 VSI list of natural resource indicators, staff compiled key management questions and possible Vital Sign topics based on review of the Gorge 2020 Management Plan revision process, informational interviews conducted for the VSI Assessment, and a staff work session completed in December 2020. (See the attached summary table for details on how the priority Natural Resource Vital Signs described below connect with the original 2009 indicators.)
- Identify **priority Vital Signs:** In the spring of 2021, staff convened a VSI Technical Work Group of natural resource and monitoring specialists from tribes, agencies, and organizations (e.g., U.S. Forest Service, U.S. Geological Survey, Yakama Nation Fisheries, National Ecological Observatory Network, Columbia River Inter-Tribal Fish Commission, East

Cascades Oak Partnership, and others) to review management questions and possible Vital Signs. The first task was determining which Vital Sign topics captured the most important attributes of protected natural resources in the Management Plan (water resources, wildlife habitat, and rare and endemic plants). Staff emphasized the Commission's guidance from the February meeting discussion that the VSI update process needs to be strategic and focused on identifying a few key indicators that are actionable and directly tied to the Management Plan, prioritizing those with existing datasets whenever possible. To ensure a thorough process, the work group reviewed the following priority habitats and other natural resources protected in the Management Plan:

Priority Habitats protected by the Management Plan

- Water-related habitats: Riparian areas, streams, and wetlands
- Forest types: Aspen stands, old-growth forests, and Oregon white oak woodlands
- Other terrestrial habitats: Grasslands, shrub-steppe, dunes, and winter range for deer and elk
- Habitat sites and features: Caves, snags and logs, talus, and cliffs

Other natural resources protected in the Plan

- Rare and endemic plants
- Culturally important plants and First Foods
- Cold water refuge fish species
- Sensitive wildlife species: Western pond turtle and pika

Staff and the work group narrowed down the list of possible Vital Signs through an iterative process considering several factors:

- Opportunity to affect condition (Forest Service land management, restoration, land use policy, etc.)
- Scale and stressors (extent in CRGNSA, potential for development, and other impacts such as invasive species and recreation)
- Climate vulnerability (relative ratings from vulnerability assessment snapshots completed for climate change action planning)
- Connection with culturally important species and First Foods

➤ Discuss **relevant indicators and datasets**: Staff has been working with the VSI Technical Work Group and other monitoring specialists to identify which indicators are most useful and feasible based on the selection criteria approved by the Commission in February. These criteria are:

1. **Measurable**: Indicators should be directly measurable through repeatable quantitative or qualitative methods.

2. **Relevant to management actions**: Indicators should provide information on the condition of protected resources related to specific Management Plan provisions.

3. **Clear**: Indicators should be understandable by the public and policymakers.

4. **Consistently available**: Indicator data should be reliably available over time to track long-term status and trends.

- 5. **Obtainable:** Indicator data should be available through existing monitoring programs whenever possible.
- 6. **Cost-effective:** Indicator data acquisition, analysis, and reporting should make efficient use of limited financial and staff resources.
- 7. **Additional Consideration:** While criteria 1-6 should be the primary criteria for selecting indicators, the ability of indicators to tell a *compelling story* that calls attention to the status of scenic, natural, cultural, and recreation resources, and economies, of the National Scenic Area, should also be considered.

As part of this review of relevant indicators and datasets, staff is considering both data availability and monitoring partners’ interest and capacity to serve as “data stewards” for specific Vital Signs. In some cases, data may be available through an online national database that staff can customize for the CRGNSA with little outside support, while in other cases, data acquisition and interpretation may require more extensive coordination with partners. Staff is currently consulting with agencies and organizations to identify relevant datasets for each Vital Sign as part of the indicator selection process.

III. DRAFT—Priority Natural Resource Vital Signs

The following tables highlight the Management Plan goal, key management question, and potential indicators being considered for each of the draft priority natural resource Vital Signs. These Vital Signs are grouped in four main categories: Water Resources and Aquatic Habitat; Terrestrial Habitat; Culturally Important and Rare Plants; and Air Quality. A summary of the rationale for each Vital Sign is provided, including how each connects with 2009 Vital Sign Indicators. As one detailed example, the Streams and Riparian Areas: Cold Water Refuge Habitat Vital Sign includes potential “target” and “possible management or policy action” information to demonstrate the next steps that are part of the VSI update process.

A. Water Resources and Aquatic Habitat

Work group members and other monitoring specialists in the region that we spoke with generally agree that water-related habitats are a high priority both when evaluating progress toward resource protection goals in the Management Plan and assessing the impacts of climate change.

Streams and Riparian Areas: Cold Water Refuge Fish Habitat

Management Plan Goal	Key Management Questions	Vital Sign	Potential Indicators	Target/ Outcome	Possible Management or Policy Action
Protect water quality, natural drainage, and fish and wildlife habitat of streams, ponds, lakes, and riparian areas.	How is water temperature changing in Cold Water Refuge streams in the CRGNSA? Are 200' stream buffers helping to protect quality cold water refuge habitat for fish?	Streams and Riparian Areas: Cold Water Refuge Fish Habitat	Stream temperature and flow	Rivers and streams in the CRGNSA that are cold enough to support salmonids (high level placeholder)	How would possible actions differ if temperatures are in healthy vs. unhealthy range on the monitored CWR streams?

Rationale: Recognizing the increasing importance of cold water refuge (CWR) habitat for migrating salmon and steelhead in the face of climate change, the revised Management Plan expands buffer widths from 100 feet to 200 feet on seven GMA streams listed as primary CWR tributaries in the EPA’s Columbia River Cold Water Refuges Plan (2020). These tributaries include the Sandy River, Hood River, Deschutes River, White Salmon River, Little White Salmon River, Klickitat River, and Wind River. Three primary CWR tributaries are in SMA: Eagle Creek, Tanner Creek, and Herman Creek, and all have 200-foot buffers.

Fall Chinook and adult summer steelhead are highly sensitive during mid-July through mid-September when Lower Columbia River temperatures often exceed 20°C. Cold water refuge habitats are limited on the Lower Columbia with 98% of available habitat located in 12 primary tributaries, ten of which are in the National Scenic Area. External factors strongly influence stream temperature and habitat condition (e.g., land use, dams, and climate change). While the Commission’s ability to directly affect stream temperature may be limited, the Commission can help protect CWR habitat through coordinated efforts including stream restoration on Forest Service lands, land use policy, and voluntary landowner stream enhancement projects. VSI data can also be used to support partners’ restoration efforts.

The Cold Water Refuge Fish Habitat Vital Sign integrates two 2009 Vital Sign Indicators, Surface Water Quality and Habitat Quality. Climate change and cold water refuge habitat were not included in the 2009 effort. This updated Vital Sign reflects what we have learned over the last decade about the importance of this habitat type for fish species facing multiple stressors exacerbated by climate change.

Wetlands

Management Plan Goal	Key Management Question	Vital Sign	Potential Indicators
Achieve no loss of wetlands acreage and functions. Improve the quality of wetlands.	What are the nature and extent of changes to wetlands in the CRGNSA over time?	Wetlands	Wetland extent; culturally important wetland plant species

Rationale: The revised Management Plan includes a “no loss” policy for wetlands. To better understand if we are meeting wetland protection goals, especially in the face of climate change impacts, more information is needed on current wetland conditions and wetland change over time in the National Scenic Area. As a starting point, tracking the extent of wetlands would provide baseline information on the current acreage of wetlands in the National Scenic Area. Staff and the VSI work group are also exploring the feasibility of a wetland function indicator such as floodplain connectivity. The Commission can affect wetland extent and condition through prohibiting and regulating uses in and near wetlands, supporting Forest Service and other partners’ restoration efforts, and encouraging landowner wetland enhancement projects. Tribal members and agency staff who we have spoken with emphasize the importance of access to traditional food plant species found in wetland and water-associated habitats.

The Wetlands Vital Sign integrates two 2009 Vital Sign Indicators, Surface Water Quality and Habitat Quality. While the 2009 “State of the Gorge” report drew from over a dozen water quality reports, watershed analyses, and restoration plans to assign overall ratings of water quality and stream habitat quality to thirteen streams in the National Scenic Area, it did not include an indicator for wetlands. The 2009 qualitative, high-level “assessment” approach involved an incredible amount of work and has value as a snapshot in time. However, it is difficult to repeat with consistency at regular reporting intervals, given the different methodologies and datasets included in each individual report. Admittedly, there are tradeoffs when comparing the past and current approaches, and the Commission must make difficult decisions about which topics are most important, while considering limited staff capacity and resources to implement a comprehensive VSI program. Advances in remote sensing technologies and increased availability of wetland land cover data over the last ten years make it easier to assess wetland extent and land use change over time. This updated Wetlands Vital Sign reflects a targeted, and intersectional, approach by thoughtfully selecting a specific protected habitat in the Management Plan to focus on that is integral to ecosystem health, culturally important plant species, and climate resilience.

B. Terrestrial Habitat

Oregon White Oak Woodlands

Management Plan Goal	Key Management Question	Vital Sign	Potential Indicators
Ensure that new uses do not adversely affect Priority Habitats or sensitive wildlife sites.	How is the condition of Oregon white oak habitat changing over time? How is land use change affecting oak systems (condition and connectivity)?	Oregon white oak woodlands	Oak extent; condition

Rationale: Oregon white oak woodlands face greater risks, and offer more opportunities for management action, than some other more protected habitats in the CRGNSA because of their large extent across the CRGNSA, numerous stressors (land development, invasive species, fire encroachment, recreation, and climate change), and high value for wildlife. The Commission can affect oak condition by supporting prescribed fire and restoration work on Forest Service lands, developing more protective Management Plan policies, and establishing best management practices and mitigation guidance for landowners. Working together with the East Cascades Oak Partnership, the Gorge Commission and Forest Service can also leverage partners’ efforts in education, monitoring, incentives, and policy development to protect and restore oak systems. In addition, oak overlaps somewhat with winter range for deer and elk, another priority habitat protected in the Management Plan.

By focusing on better understanding the current extent and condition of oak across the CRGNSA, the Oregon White Oak Woodlands Vital Sign integrates the 2009 indicators for Habitat Quality and Habitat Fragmentation.

Grasslands/Prairies

Management Plan Goal	Key Management Question	Vital Sign	Potential Indicators
Ensure that new uses do not adversely affect Priority Habitats or sensitive wildlife sites.	Where are the most in-tact, functional grasslands in the CRGNSA? How are the extent and condition of grasslands changing over time?	Grasslands/Prairies	Grassland extent; native bunch grass species presence/extent; invasive grass species extent

Rationale: Similar to Oregon white oak woodlands, grasslands face significant development pressure and potential for habitat fragmentation. The highest diversity of pollinators in the CRGNSA are found in oak savannah where oak and grassland meet. Rare and endemic plant species are also present here. Grasslands are highly vulnerable to climate change impacts including drought and warming air temperatures, hydrologic shifts, and changing fire dynamics. The consequences of these changes include conversion to invasive annual grasses, already the main stressor on native grasslands in the CRGNSA. Given the large-scale impact of invasive grasses on native grasslands, one primary role of VSI may be to identify restoration opportunities, in addition to identifying remaining areas of in-tact grasslands.

The Grasslands/Prairies Vital Sign also integrates the 2009 Habitat Quality and Habitat Fragmentation indicators.

C. Culturally Important and Rare Plants

Management Plan Goal	Key Management Question	Vital Sign	Potential Indicators
Ensure that new uses do not adversely affect rare plant species and ecosystems. Enhance the natural habitats of rare plant species.	What is the condition of culturally important plant species, including First Foods, in the CRGNSA? How are populations of rare and endemic plants changing over time?	Culturally Important and Rare Plants	Species presence/extent; seasonal changes recorded through interviews

Rationale: As part of both climate change action planning and VSI work, staff have heard from a number of tribal members and several tribes' cultural and natural resource agency staff about the irreplaceable value of culturally important plants and access for traditional gathering. Initial VSI conversations have centered around opportunities to use plants as indicators of associated habitat types in a way that protects the confidentiality of location and specific species information. Currently, staff is exploring with tribal members and agency staff how we may support their interests and efforts while respecting confidentiality and their lead role in this work. A Culturally Important Plants Vital Sign offers an opportunity to integrate tribal communities' knowledge about local environments developed over thousands of years, often called traditional ecological knowledge (TEK), into the VSI monitoring framework.

In addition to culturally important plants, staff have expressed the need for better information on the location, and likelihood, of rare plants on private lands to help determine when they should require surveys and measures to protect and enhance rare plants. With more localized rare plant location data, staff would be better prepared to help landowners address specific concerns on their property by connecting them with resources and partner organizations focused on enhancement activities, such as native planting and invasive species removal.

The Culturally Important and Rare Plants Vital Sign integrates the 2009 indicators for Species Health (only had data available for plants at that time) and Species Range (intended to be developed in 2011).

D. Air Quality

Management Plan Goal	Key Management Question	Vital Sign	Potential Indicators
Air quality shall be protected and enhanced, consistent with the purposes of the National Scenic Area Act.	Is air quality and visibility improving in the CRGNSA, since the Columbia Gorge Regional Air Quality Strategy was implemented?	Air Quality	Visibility (particulate matter), precipitation chemistry, lichen abundance and air pollutant deposition

History of Air Quality Planning in the CRGNSA

The Gorge Commission’s commitment to address air quality in the National Scenic Area through a regional planning approach dates back more than twenty years. The main air quality concerns noted at that time were visibility impairment, or haze pollution, and the effects of air pollution on natural and cultural resources. On May 9, 2000, the Gorge Commission adopted an amendment to the Management Plan directing the states of Oregon and Washington, in coordination with the Southwest Clean Air Agency (SWCAA) and the Forest Service, and in consultation with affected stakeholders, to develop and implement a regional air quality strategy. The following language from this 2000 amendment remains in the revised Management Plan adopted on October 13, 2020:

Revised Management Plan:

Part 1, Chapter 3: Natural Resources, SMA Provisions, Wildlife and Plants, Policy 15

15. Air quality shall be protected and enhanced, consistent with the purposes of the National Scenic Area Act. The states of Oregon and Washington and the Forest Service shall:

- A. Continue to monitor air pollution and visibility levels in the Gorge;*
- B. Conduct an analysis of monitoring and emissions data to identify all sources, both inside and outside the National Scenic Area, that significantly contribute to air pollution. Based on this analysis, the states of Oregon and Washington shall develop and implement a regional air quality strategy to carry out the purposes of the National Scenic Area Act, with the Forest Service, the Southwest Air Pollution Control Authority and in consultation with affected stakeholders.*

The states of Oregon and Washington and the Forest Service shall together provide annual reports to the Gorge Commission on progress made regarding

implementation of this policy. The first report shall include a workplan and timeline for gathering/analyzing data and developing and implementing the strategy. The workplan and strategy shall be submitted to the Gorge Commission for approval.

In 2001, the Gorge Commission approved a workplan for this air quality plan amendment and approved a revised workplan in 2003. A year later, the air agencies—Oregon Department of Environmental Quality (DEQ), Washington Department of Ecology (ECY), and SWCAA—initiated an air quality study focused on identifying haze-contributing sources in the Gorge. This study included collection and analysis of monitoring data, chemical analysis of haze, and computer model simulations. In 2007, the air agencies hosted a Gorge Science Day for the Gorge Commission and stakeholders, followed by release of a draft air quality strategy for public review in 2008.

At its September 2011 meeting, the Commission approved the Columbia River Gorge Air Study and Strategy. Specifically, this strategy recommended using the federal Regional Haze Program as the framework for monitoring and improving visibility in the CRGNSA. Under the Regional Haze Program, state and federal agencies work together to improve visibility in 156 national parks and wilderness areas across the country, referred to as Mandatory Class 1 Areas. Though not designated a Class 1 Area, the Columbia River Gorge National Scenic Area is included in the Regional Haze program, given its proximity to two Class I areas (Mt. Hood and Mt. Adams) and its high-value scenic resources.

Rationale for Air Quality Vital Sign: The Management Plan requires the states of Oregon and Washington and the Forest Service to “continue to monitor air pollution and visibility levels in the Gorge” and “provide annual reports to the Gorge Commission on progress made regarding implementation of this policy [regional air quality strategy].” Currently, the Forest Service CRGNSA unit is engaged in two air quality monitoring programs: National Atmospheric Deposition Program (NADP) looking at precipitation chemistry, and Interagency Monitoring of Protected Visual Environments (IMPROVE) assessing visibility as part of the EPA Regional Haze Program. These two programs, along with a regional 20-year Forest Service monitoring effort using lichen as an indicator of air quality, offer datasets that can be used for an Air Quality Vital Sign. For example, by using IMPROVE data for an air quality indicator, the Commission and its partners could continue to track haze pollution in the National Scenic Area, especially changes following the closure of Portland General Electric’s Boardman coal-fired power plant in October 2020. In addition, the Commission can use air quality as a climate-related indicator to inform possible climate change mitigation actions (e.g., transportation-related emissions reduction) and better understand air quality impacts from wildfire smoke on protected resources and local economies.

This Air Quality Vital Sign brings to fruition two, “to be developed” indicators in the 2009 VSI report: Air Quality (under Natural Resources) and Visibility (under Scenic Resources). While the 2009 report included a summary of air quality studies and reports available at that time, specific indicators had not been established yet. Staff are currently evaluating all three potential indicators described above based on indicator selection criteria.

IV. Progress on Climate Change Vital Signs

In addition to discussing natural resource vital signs, the VSI Technical Work Group explored key management questions, vital sign topics, and relevant indicators for climate change. Staff and the work group integrated climate vulnerability rankings from the climate change action planning effort

in review of all potential natural resource vital sign topics. Thus, all Draft Priority Natural Resource Vital Signs in this report reflect consideration of climate change impacts and ranked “High” or “Very High” for climate vulnerability (see the Climate Change Action Plan Progress Report, June 8, 2020, for more details).

The Climate Change Chapter directs the Gorge Commission to include climate change indicators as part of the VSI program. Staff and work group discussions reveal there are different ways to accomplish this goal: (1) Establish separate climate Vital Signs for Commission priorities that are not explicitly captured through other natural resource vital signs (e.g., wildfire risk); (2) Incorporate a climate change indicator within a natural resource Vital Sign (e.g., stream temperature for Cold Water Refuge Fish Habitat), or (3) Combine both approaches as needed. The update below focuses on two topics of Commission interest related to climate change: wildfire risk and carbon storage. This summary reflects staff’s initial exploration of these topics and questions that require more in-depth analysis before developing specific recommendations.

A. Wildfire Risk

One of the main impacts of climate change in the National Scenic Area is increased frequency and severity of wildfire. Building shared understanding of the different fire regimes at play in the gorge is critical for communities to be able to plan for and adapt to increased wildfire risk. Consideration of wildfire risk as a Vital Sign involves several questions, from how to increase public awareness to specific land use policy applications: How has fire affected diverse habitats here in the past and what can we expect in a future of climate change? How is fire likely to shape the west-side coniferous forests, the oak woodlands, and the grasslands of the eastern gorge? How is the spatial distribution of wildfire risk across land use designations (LUDs) in the CRGNSA changing over time? How does wildfire risk overlap with areas of potential development?

The Commission approved two new policies in the revised Management Plan that address wildfire risk and land use:

Provide information on Firewise guidelines to landowners

(Part II-Chapter 1: GMA Policy 14 and Chapter 4: GMA Policy 6)

Prohibit new dwellings on Commercial Forest and Large Woodland

(Part II-Chapter 2: GMA Policy 7)

Staff are exploring different spatial data and planning tools to assess current fire risk and track changes in fire risk over time (e.g., USFS and Department of Interior LANDFIRE program and Potential Operational Delineations (PODs) approach to strategic wildfire risk planning). More information is needed to determine if data available through these tools are best suited for a one-time risk assessment, rather than long-term monitoring. As a starting point, one indicator for wildfire risk could focus on tracking the number of landowners who incorporate voluntary Firewise standards in development proposals.

B. Carbon Storage

The role that different habitats and land uses in the National Scenic Area play in sequestering carbon is important to understand when considering long-term impacts of climate change and possible mitigation actions. Key management questions include: What is the current carbon storage capacity of forests, wetlands, grasslands, and agricultural lands in the National Scenic Area and how

is this changing over time? Where are the areas with highest carbon storage capacity, and how do these overlap with areas of potential development?

While there are national datasets that provide information on forest and soil carbon storage, it is challenging to find data at a fine enough scale to assess carbon storage of specific priority habitats or land use designations within the National Scenic Area. The Forest Service Vulnerability Assessment conducted for the National Scenic Area reported forest carbon density data for one sampling year during the 2005-2013 period. More information is needed to determine whether the carbon analysis methods used in this report could be repeated at a spatial and temporal scale useful for long-term monitoring.

Non-forested lands—such as wetlands, grasslands, and agricultural lands—provide significant carbon storage as well. Staff are exploring relevant carbon storage data sources for these lands along with forests. More work is needed to determine whether a one-time assessment (as an action item in the Climate Change Action Plan, for example) or long-term monitoring is most useful and feasible to answer key management questions.

VI. Next Steps for Natural Resource and Climate Change Vital Signs Review

- Incorporating Commission feedback on draft priority Natural Resource and Climate Change Vital Sign topics, staff will continue to identify available data and refine indicators based on Commission priorities.
- Staff will discuss the feasibility of developing targets (desired conditions that demonstrate achievement of Management Plan goals) for Natural Resource and Climate Change Vital Signs.

VII. Topics for Commission Consideration

Below are suggested discussion items for the VSI work session on June 8, 2021:

Discussion Items:

- Discuss and provide feedback on the **draft list of priority Natural Resource Vital Signs**
 - Do the draft Vital Signs capture the key protected resources we should be focusing on to assess progress toward Management Goals?
- Discuss and provide feedback on **potential Climate Change Vital Sign topics**
 - Are there climate-related impacts and trends that need to be monitored through a unique Climate Change Vital Sign that are not captured through Natural Resource Vital Signs?

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Appendix: 2009 Natural Resource Vital Sign Indicators and Draft 2021 Natural Resource Vital Signs Cross-Walk Chart

This chart describes how the 2021 Draft Priority Natural Resource Vital Signs highlighted in this report build upon the 2009 Natural Resource Vital Sign Indicators.

2009 Natural Resource Vital Sign Indicators								DRAFT 2021 Natural Resource Vital Signs
Objective	Vital Sign Number	Vital Sign Title	Measure	Proxy Measure	Year Reported	Connects to Management Plan Provision? YES/NO/UNCLEAR	Management Plan Reference & Notes	
2.1 Protect and Enhance the Native Plants and Animals and the Habitats Which Support Them	2.1.a	Habitat Quality	Percent of priority habitat types rated as properly functioning	Number of important landscape elements in the Scenic Area that are functioning at high levels	2009	YES on Vital Sign; Review of measures needed	Part 1: Chapter 3, GMA Goal 1: "Ensure that new uses do not adversely affect Priority Habitats or sensitive wildlife sites."	Terrestrial Habitat: Oregon White Oak Woodlands Grasslands/Prairies
	2.1.b	Habitat Fragmentation	Percent of priority habitat types that are lost or fragmented by human activity		TBD in 2011	YES on Vital Sign because habitat fragmentation connects with habitat quality; Review of measures needed	See Habitat Quality reference. Wildlife consult for development reviews includes assessment of habitat integrity. Connectivity is part of integrity.	
	2.1.c	Species Health	Percent of at-risk species whose populations in the gorge are healthy	Note: In 2009, only reported on plants; no assessments of animal species available.	2009	YES on Vital Sign because species health connects with habitat quality; Review of measures needed	See Habitat Quality reference for wildlife and Part 1: Chapter 3, GMA and SMA Goals for Rare Plants. (Note: This measure could apply to plants or wildlife.)	Culturally Important and Rare Plants
	2.1.d	Species Range	Percent of native species (wildlife, plants, invertebrates) with ranges that are declining		TBD in 2011	YES on Vital Sign because species range connects with habitat quality; Review of measures needed	See Habitat Quality reference for wildlife and Part 1: Chapter 3, GMA and SMA Goals for Rare Plants. (Note: This measure could apply to plants or wildlife.)	
2.2 Protect and Enhance Quality of the Water and Aquatic Habitats	2.2.a	Surface Water Quality	Percent of streams, including Columbia River, whose water quality is (a) poor, (b) fair, (c) good, and (d) excellent.	Number of watersheds, including the Columbia River, where water quality is (a) impaired and (b) good.	2009	YES on Vital Sign because water quality connects with aquatic habitat quality; Review of measures needed	Part 1: Chapter 3, GMA Goal 3: "Protect water quality, natural drainage, and fish and wildlife habitat of streams, ponds, lakes, and riparian areas."	Water Resources and Aquatic Habitat: Streams and Riparian Areas--Cold Water Refuge Fish Habitat Wetlands
	2.2.b	Habitat Quality	Percent of native fish habitat that is properly functioning		2009	YES on Vital Sign; Review of measures needed	Part 1: Chapter 3, GMA Goal 3: "Protect water quality, natural drainage, and fish and wildlife habitat of streams, ponds, lakes, and riparian areas."	
	2.2.c	Surface Water Quantity	Percent of streams with satisfactory in-stream flows		TBD in 2011	UNCLEAR	Commission does not manage for water quantity.	
	2.2.d	Groundwater Quantity	Square miles of groundwater restricted areas		TBD in 2011	NO	Currently, not Commission's role to regulate groundwater. Is there information we want to collect to inform consideration of a policy change in the future?	
	2.2.e	Groundwater Quality	To be developed		TBD in 2011	NO		
2.3 Protect and Enhance Quality of the Air	2.3.a	Air Quality	To be developed		Summary in 2009	YES on Vital Sign; Review of measures needed	Part I: Chapter 3, Wildlife and Plants, SMA Policy 15: "Air quality shall be protected and enhanced, consistent with the purposes of the National Scenic Area Act." Includes requirement for states of OR and WA and the Forest Service to "continue to monitor air pollution and visibility levels in the Gorge" and "provide annual reports to the Gorge Commission on progress made regarding implementation of this policy [regional air quality strategy]."	Air Quality