GREENPRINT RESOURCEHub

Science and Data Overview

Greenprints serve as a bridge between data creators and practitioners. Greenprints compile data from multiple sources, synthesize the relevant information in one place, and translate complex data into meaningful information for end users. By making a wide variety of data readily available and comprehensible, greenprints make it easier for the audience to find the information they need.

Data in a greenprint might include cutting-edge scientific data like climate change projections or output from hydrologic models, but a Greenprint user does not need to be an expert on climate science or hydrology to use this information to make land use decisions. The role of the greenprint is to translate scientific research into information that can be used by anyone to guide decisions.

Greenprints in Action: The Bay Area Greenprint

The Bay Area Greenprint shares the dataset Climatic Water Deficit, defined as "evaporative demand exceeding available soil moisture." Instead of sharing the raw data, the Bay Area Greenprint uses this dataset to explain the resource goal "How will climate change impact food production?"

Data that goes in:	→	Metric that comes out:
Projected climate-driven changes in climate water deficit		How will climate change impact food production? X gallons of additional irrigation would be needed to maintain the same crops in the same location

This metric frames the dataset in the context of climate change and food production to help plan for future resources or land uses. The audience for this greenprint is more interested in how climate change will affect their crops, rather than trying to interpret the climate water deficit output.

Key Questions- Greenprint Themes

The data and metrics within a greenprint are organized into ***themes***: broad categories that provide structure to the data. Themes should be intuitive so users can easily find each dataset. The themes for each greenprint will depend on the specific resource goals. Some of the most common themes in greenprints are listed below, but many greenprints will only include a subset of these themes.

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Common Goals/Themes

1. **Water Quality and Supply:** Ensuring access to clean water is essential for people, agriculture, diverse species, and healthy ecosystems.
2. **Biodiversity and Habitat:** Conserving habitats and the natural linkages between them will allow plants and animals to thrive.
3. **Rural and Working Lands:** Working lands, including farms and ranches, produce food and fuel and play a vital role in supporting jobs and the economy.
4. **Climate Resilience:** Building resilience to flooding, wildfires, and other impacts of climate change will strengthen communities and ecosystems so they can adapt and withstand these disturbances.
5. **Parks and Open Space Access:** Open space provides wildlife habitat and benefits human health, through air purification, recreational opportunities, and the reduction of extreme heat.
6. **Cultural and Historic Resources**: Cultural resources are crucial for providing a sense of community and understanding the historic identity of a place.
7. **Health and Equity:** Marginalized communities have been disproportionately impacted by environmental hazards, and environmental justice is essential to ensure that all people live in healthy communities.
8. **Partnership and Funding Opportunities:** Considering strategic partnerships and funding opportunities can help build support for sustainable development and secure the resources needed to achieve the greenprint's goals.

Examples of what is included as Themes and Goals

Water Quality and Supply Watersheds Stormwater runoff Rivers and streams Groundwater recharge zones	**Biodiversity and Habitat** Species habitat Rare species occurrences Habitat connectivity	**Rural and Working Lands** Farm and ranch land data Areas for fishing, hunting, or foraging Rural character and viewsheds Dark skies	**Climate Resilience** Carbon sequestration Flood risk Extreme heat risk Wildfire risk Coastal protection Air quality
Parks and Open Space Access Publicly accessible protected lands Access to parks and trails Access to nature-based programming	**Cultural and Historic Resources** Indigenous traditional territories Sacred sites Designated historic sites	**Health and Equity** Air quality and air pollution Socioeconomic vulnerability Food and healthcare access Housing, employment, and transportation access Health inequity and poor health outcomes	**Partnership and Funding Opportunities** Places to partner with Indigenous groups Service area overlaps for agencies and organizations Priority areas for funding sources

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Greenprint Metrics

Metrics summarize and interpret the data for an area of interest. Metrics can be presented in a table, a chart, or as a numerical value with associated text. For example, for a resource goal of "protecting water quality," one metric could be "10.2 miles of impaired streams are within the area of interest." Knowing the extent of impaired streams can help users determine whether they want to prioritize water quality improvements.

Each dataset can be summarized in many ways, leading to multiple options for metrics. To list a few examples of basic metrics, the greenprint could report on the *number* of impaired streams, the *length* of impaired streams, or the *percent* of impaired streams in the area. It's up to the greenprint developer, with input from potential end users, to decide what metric is most useful for the audience. Each dataset and metric should also be linked to a data definition and a source for transparency.

A metric can also include additional background or context information. Providing additional information can help explain the significance of a natural resource. The following list provides examples of context that can be included in more detailed metrics to help explain why a resource is important. Each option includes sample text using the impaired streams example.

- **Just the facts** ("X miles of impaired streams")
- **Regional significance**("This area contains X% of the impaired streams in the state")
- **Landscape context** ("X miles of impaired streams are within protected areas that house threatened species.")
- **Risk level** to the resource ("X miles of unimpaired streams are in an area at risk of development, which could lead to more water pollution.")
- **Inequitable distribution** ("There are X more miles of impaired streams in low-income communities than in high-income communities.")
- **Historical trends** ("The number of impaired streams has been increased by X% over the past 20 years.")
- **Thresholds** that can impact ecological or human health. ("Having more than X amount of impaired streams may have an impact on local drinking water sources.")

Sharing this context information with end users could lead to users implementing different actions. For example, if users know if a resource is inequitably distributed, they may want to focus restoration efforts in low-income communities.

In some cases, such as the examples listed so far, greenprints provide solely ***descriptive metrics***, summarizing information to describe conditions of a resource on the landscape. Greenprints can also be designed to provide ***action-oriented metrics*** that offer solutions or recommendations related to resources. For example, a descriptive metric would report that "there are 10 acres in this area impacted by urban heat island," while an action-oriented metric would add that "planting street trees in this area can help cool temperatures to address the

effects of urban heat islands." Deciding whether to use descriptive or action-oriented metrics depends on the goals, users, and developers of the greenprint.

Greenprint Data

Most datasets in a greenprint can be displayed spatially and should correspond to a resource goal or a theme. Relevant datasets can be crowdsourced from end users, partners, and anyone else engaged in developing a greenprint. After there is a comprehensive list of potential data that represents all resource goals, you can narrow down the list by identifying the most crucial data for your targeted user groups. In the United States, there are many national-scale datasets, but local sources may have higher accuracy and resolution. The key questions section on data provides additional detail on what type of data to use and how to incorporate data into greenprints. The resources and tools section includes a number helpful sources of data.

In a greenprint, the data can be conveyed in two ways: (1) as spatial layers displayed on a map, and (2) in a report as metrics.

Science in Action

The section below shows examples of how data can be translated through the greenprinting process, in order to make the information presented more meaningful to users.

For each of these theme topics, you'll find a related question and then two examples of ***how***:

1. *Metrics* answer the question related to the theme and
2. What *datasets* are used to support that answer

Water Quality and Supply

- Question: Which areas are at risk of flooding?
    - Metric: Acres within the 100-year floodplain. Climate change may increase the extent of flooding. Green infrastructure can help mitigate the impacts of flood water to urban areas.
    - Dataset (US): FEMA Flood Maps

- Question: Where does our drinking water come from?
    - Metric: Your project area includes a drinking water source area. Pollution in this area could impact drinking water quality.
    - Dataset (local): Drinking water source areas in Oregon from the Department of Environmental Quality

Biodiversity and Habitat

- Question: Which areas are critical for species connectivity?
    - Metric: Acres of land within a climate linkage. These linkages are the last remaining natural lands within a modified landscape, and they also connect current climate conditions to similar conditions in the future. Maintaining habitat connectivity within these linkages will help facilitate species movement through climate change.
    - Dataset (US): Connectivity and climate flow from The Nature Conservancy Resilient Land Mapping Tool

- Question: What is the diversity of plant and animal species?
    - Metric: Number of species observed within your project area.
    - Dataset (local): India Biodiversity Portal

Rural and Working Lands

- Question: Where are the most productive agricultural soils?
    - Metric: Acres of prime agricultural land.
    - Dataset (US): Irrigated Capability Class from the USDA Soil Survey Geographic Database
- Question: Where are opportunities to expand access to healthy foods?
    - Metric: Number of community gardens within 5 miles. In urban areas, community gardens can provide access to healthy foods.
    - Dataset (local): GreenThumb Community Garden Map from NYC Parks

Climate Resilience

- Question: Which areas are at high risk of wildfire?
    - Metric: Acres with very high likelihood of wildfire. Fuels management and controlled burns can help return fire to its beneficial role.
    - Dataset (US): Wildfire Risk to Communities from the USDA Forest Service
- Question: Where is carbon stored in the landscape?
    - Metric: Metric tons of CO_2 equivalent stored in vegetation. Vegetation in this region is at risk of development, and any disturbances in this area would release greenhouse gas emissions.
    - Dataset (local): Wildland carbon storage in California from Gonzalez et al. 2015

Parks and Open Space Access

- Question: How can we expand access to outdoor recreation?
    - Metric: Acres with a very high need for park access (residents in that area are currently more than a 10 minute walk from a park). Many parks in this region are inequitably distributed, with more access to parks in higher income communities. Parks have health and recreation benefits, and it is important to increase accessibility to parks for all urban residents.
    - Dataset (US): Priority areas for new parks from the Trust for Public Land

- Question: How can we reduce exposure to high temperatures?
    - Metric: Temperature difference between urban centers and surrounding rural areas. Urban heat islands, due to impervious surfaces and lack of canopy cover, can lead to heat-related illness and death. Planting trees can provide shade and cooling.
    - Dataset (local): Urban Heat Island in 5 cities from the Sustaining Urban Places Research Lab

Cultural and Historic Resources

- Question: Which Indigenous people traditionally inhabited this region?
    - Metric: The traditional territories of the project area. Knowing the historical and ongoing presence of Indigenous peoples in the region acknowledges their connections to the land.
    - Dataset (US): Native Land Digital
- Question: Does the area contain designated historic sites?
    - Metric: Number of registered historic places within the project area. Historic places may have special protections or restrictions on development.
    - Dataset (US): National Register of Historic Places from National Park Service

Health and Equity

- Question: What is the exposure of air pollution in this area?
    - Metric: The national percentile of PM2.5. High levels of PM2.5 can cause health problems, such as respiratory issues, especially for vulnerable populations. Vegetation can help filter out air pollutants including PM2.5.
    - Dataset (US): Environmental Justice Screening and Mapping Tool from US EPA
- Question: Is there equitable access to public transportation?
    - Metric: The statewide percentile of transportation access. In general, marginalized communities have lower access to public transportation, but are also more impacted by harmful air pollution from the transit system.
    - Dataset (local): Transportation Equity in Massachusetts from MassROUTES

Partnership and Funding Opportunities

- Question: Which government agencies have a stake in the area?
    - Metric: Ownership of public lands adjacent to the project area. Nearby agencies may be interested in engaging in a partnership.
    - Dataset (US): Inventory of protected areas from USGS
- Question: Are there priority development areas that have financial benefits?
    - Metric: Whether or not the project area falls within an Opportunity Zone. Developments in communities identified as Opportunity Zones may be eligible for tax incentives.
    - Dataset (local): Opportunity zones in Chicago from the City of Chicago