

Prepared in cooperation with the U.S. Department of Agriculture Office of Environmental Markets

# A Database of Biodiversity and Habitat Quantification Tools Used in Market-Based Conservation

Market-based conservation uses economic incentives to leverage market forces in ways that encourage and improve efficiency in the restoration, enhancement, and preservation of species and habitats. Biodiversity and habitat quantification tools are vital to the operation of this conservation strategy, as they are used to measure the quality and functionality of areas of land that have undergone or are proposed for preservation, improvement, or development activities (for example, construction of energy or transportation infrastructure and residential development).

The U.S. Geological Survey (USGS) Science and Decisions Center in partnership with the U.S. Department of Agriculture Office of Environmental Markets have created a database of the quantification tools available for use in biodiversity and habitat markets in the contiguous United States. This database provides landowners, regulatory agencies, tool developers, and the general public with a central location from which to search for and identify the tools applicable to specific species, habitats, or locations of interest, such as those shown in figures 1 and 2. The database contains summary information about the intended application and features of each tool and will be updated as the need to add new tools warrants.

## Market-Based Conservation in the United States

Market-based conservation operates through the sale and purchase of ‘goods’, such as improved environmental conditions, protected or restored species and habitats, and consumer products produced in an environmentally responsible way. Various compensatory and voluntary mechanisms are used

to promote conservation under this market-based strategy. For example, compensatory mitigation programs, such as conservation banking, require that incidental impacts to certain species protected under local, State, or Federal law (for example, threatened, endangered, or at-risk species) be offset through the purchase of species or habitat credits associated with a permanently protected area of land managed for these species. Some voluntary programs provide financial payments or technical assistance to landowners for ‘ecosystem services’ provided by their land (such as improved water quality and wildlife habitat), thus giving landowners incentive to conserve, restore, or manage important habitats on private lands voluntarily. Another voluntary program, eco-label certification, gives manufacturers a way to appeal to customers concerned about the environmental impacts of production operations. Habitat exchanges, which are designed to facilitate the buying and selling of species or habitat credits, may employ both compensatory and voluntary mechanisms. Each of these mechanisms uses quantification tools to measure the biodiversity or habitat benefits associated with preservation, restoration, or enhancement activities—including the estimated quality and functionality of the impacted, conserved, or improved habitats. Quantification tools are therefore an important component in the performance and success of market-based conservation.

Despite the importance of quantification tools to these markets, several tool-related issues may be limiting market performance and growth. For example, existing tools are not yet widely available, they can be hard to find, and they are applicable to only a limited number of species and geographic regions. Also, detailed information about

tool functionality (how and what the tools measure, their features and technical requirements, and who to contact with questions) is often difficult to obtain. These issues have potentially restricted the wider application of many tools, increased the likelihood of developing redundant tools, and introduced uncertainty about the usefulness of tools to market-based conservation.



**Figure 1.** The steep population decline of the monarch butterfly (*Danaus plexippus* [Linnaeus, 1758]) has made the species a conservation priority in the United States. A habitat quantification tool developed by the Environmental Defense Fund aims to assess habitat quality throughout the species’ U.S. range to encourage habitat conservation and restoration efforts. Photograph credit: Loren Merrill Photography



**Figure 2.** Numerous quantification tools assess the quality and functionality of wetlands and other aquatic habitat. These tools often examine how such habitats support the plant and animal species that use them. Photograph credit: U.S. Fish and Wildlife Service

## Benefits of the Quantification Tools Database

The publicly accessible, searchable database of existing biodiversity and habitat quantification tools is intended to address the concerns mentioned above by providing the following benefits:

*Find tools more easily.*—The database provides a centralized location that allows landowners, regulatory agencies, tool developers, and the general public to easily search for, find, and understand the features of available tools.

*Eliminate redundancy in tools.*—The database allows users to quickly find tools that might suit their needs, thereby minimizing redundant tool-building efforts (that is, building a tool for a species or habitat for which a suitable tool already exists). Also, when new tools are needed, tool developers can use the database to identify features of existing tools that they may find useful to incorporate into their new tools.

*Improve standardization among metrics.*—By providing a way for tool users to find existing tools, the database can help promote the application of the same tool to situations involving the same species or habitat. This could lead to a more standardized system for measuring habitat quality and functionality. The

use of specific tools for the same or very similar purposes can also support increased consistency and comparability among preservation, restoration, and enhancement efforts.

*Assess and improve tool functionality.*—The database makes tool information, including tool features, widely available for independent evaluation to ensure that the tools' functionality and effectiveness at measuring site quality are easily understood, scientifically defensible, and accurate—and, if not, where changes to tools are needed.

*Fill tool gaps.*—The database makes it easier for tool developers to identify species and habitats for which tools and markets have not yet been developed. This knowledge can help direct tool development efforts and facilitate market expansion.

*Reduce administrative burden.*—The use of an established tool for assessing habitat quality and functionality that has previously received approval by Federal regulators or others can reduce the time needed for agencies and other organizations to review and approve new projects. For some markets, long project approval processes are considered an impediment to greater market participation.

## What the Database Contains

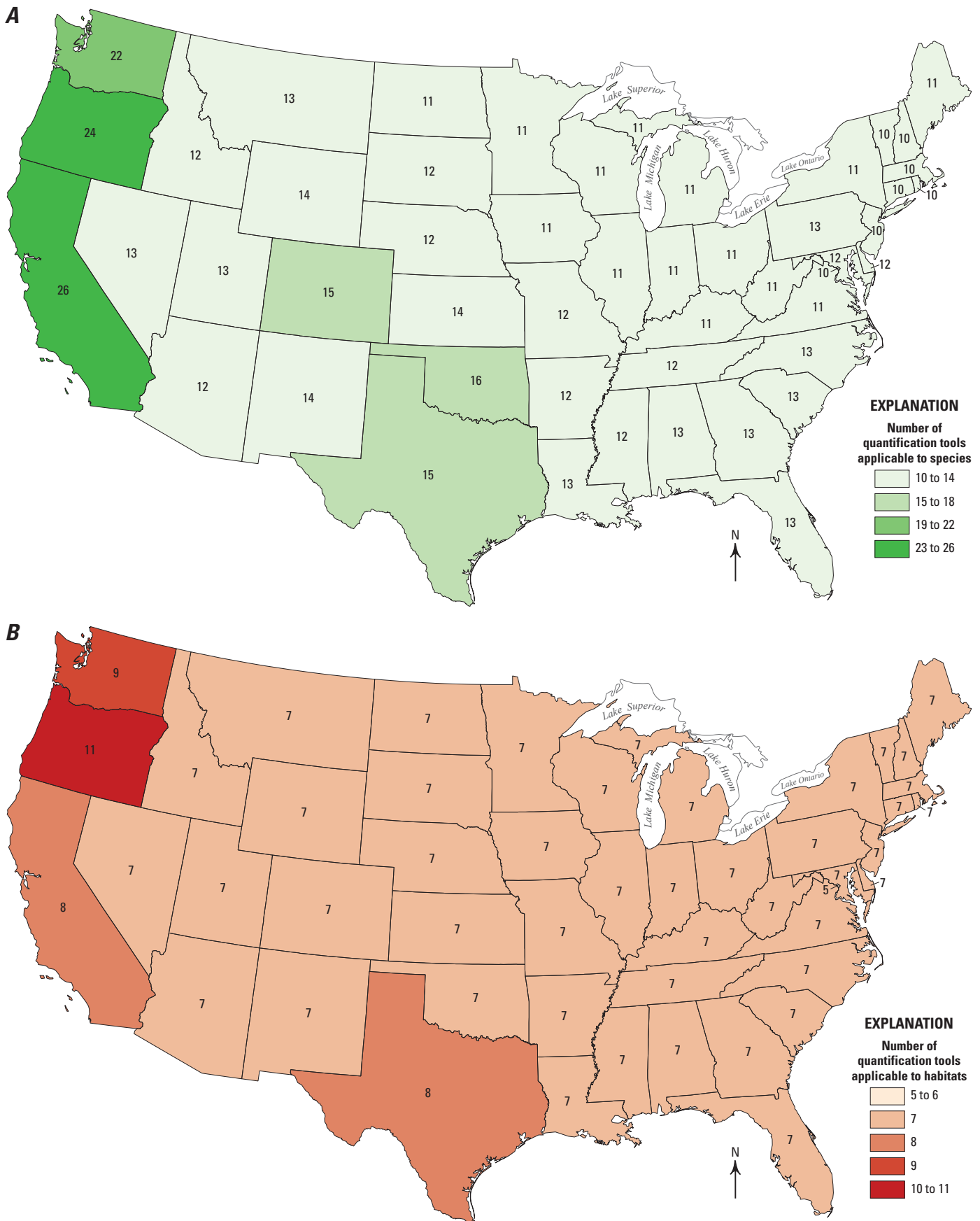
The database describes the features of 69 tools that collectively assess at least 34 species and 39 habitat types throughout the contiguous United States (fig. 3). The database will be updated over time to incorporate new tools or updated versions of existing tools. The details (features) that convey information about each tool can be broken down into three broad categories: (1) general, (2) ecological and geographic, and (3) technical (table 1). The types of information listed in the database help illustrate how a tool assesses habitat quality and functionality, which in turn helps database users determine if a tool will fit their needs. The information also helps illuminate potential taxonomic, habitat, or regional gaps in tool coverage that could be filled by new tools.

The information provided for each tool was obtained from technical documents, such as user guides, credit calculators, and scientific methods documents. Because not every tool had a user guide or an associated scientific methods document, expert feedback or other sources of information were also used to obtain information about a tool.

**Table 1.** Types of descriptive information contained in the database of quantification tools used in biodiversity and habitat markets in the United States.

[Information in this table is grouped into categories to aid interpretation; information in the database is not separated by these categories]

General Information	Ecological and Geographic Information	Technical Information
•Tool name	•Focal taxa	•Number of data inputs
•Brief description of tool's purpose	•Focal habitat(s)	•Data input platform
•Tool pricing	•Location(s) of use	•Output units
•Tool status	•Level of transferability	•Spatial mapping needs
•Tool owner(s)	•Species presence and (or) abundance incorporated	•Field data needed
•Tool owner affiliation	•Connectivity incorporated	•Requires new data
•Tool developer(s)	•Number of spatial scales assessed	•Field visit time
•Year tool was developed	•Risk viability factors	•Assesses impacts
•Year of most recent documents		•Update schedule
•Conservation approach to which tool applies		
•Market type to which tool applies		
•Intended users		
•User skill level		
•Associated document(s)		
•Associated website(s)		
•Point(s) of contact		
•Funding source(s)		



**Figure 3.** Maps showing the number of quantification tools designed for biodiversity and habitat markets that could be applied to species (A) or habitats (B) throughout the contiguous United States. The greater availability of species and habitat tools in California, Oregon, and Washington is most likely a result of the unique and vulnerable ecosystems, the variety of threats to those ecosystems, and the incentives (regulatory and consumer-based) available in those States that encourage ecosystem protection through the use of biodiversity and habitat markets.

## How to Access the Database

Users can access and download the database of biodiversity and habitat quantification tools by visiting <https://doi.org/10.5066/F79G5M3X>. The database is available on this website as several files in comma separated value (.csv file extension) format for users who do not have access to Microsoft Office software and as a single Excel file (.xls file extension) for those with access to Microsoft Excel software.

## For More Information

- On biodiversity and habitat market-based conservation:  
Pindilli, E., and Casey, F., 2015, Biodiversity and habitat markets—Policy, economic, and ecological implications of market-based conservation: U.S. Geological Survey Circular 1414, 60 p., <http://dx.doi.org/10.3133/cir1414>.
- On the quantification tools database:  
Chiavacci, S.J., and Pindilli, E.J., 2018, Database of biodiversity and habitat quantification tools used for market-based conservation in the United States: U.S. Geological Survey Data Release, <https://doi.org/10.5066/F79G5M3X>.

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The biodiversity and habitat quantification tools database contains information on measurement tools designed to assess changes in habitat quality and functionality associated with land development activities as well as with habitat restoration, enhancement, and preservation. This publicly available database will help improve accessibility to tools, broaden understanding of how tools work, and facilitate the efficient use of market-based conservation.



Photograph credit: U.S. Fish and Wildlife Service

**The USGS Science and Decisions Center is an interdisciplinary organization advancing the use of science in natural resource decision making. For more information, please contact:**

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ISSN 2327-6916 (print)  
ISSN 2327-6932 (online)  
<https://doi.org/10.3133/fs20183039>

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