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Title
Riparian habitat inventory and assessment agreement

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The first fact to know about CARA is that participating groups or individuals collectively felt that scores of sets of facts were critical to their individual or cooperative work with California's rivers. In all, 99 sets of statewide, regional, or local data were integrated directly into CARA. Links were created to another 206 internet providers of information.

CARA contains 39 sets of mapped geographical information system (GIS) layers, 60 sets of tabular (database) and textual (text) data, as well as links (internet connections) to 510 additional maps, tables and texts located on other servers. All of this data is organized by watershed and theme. CARA makes the data available to interested parties over the internet for a wide variety of analytical and management purposes.

CARA GIS data layers include the location of rivers, the distributions of riparian and aquatic species, the location of endangered species sightings, habitat locations, the locations of dams, water diversions, irrigation systems, road crossings, as well as all sorts of political and administrative boundaries. Each GIS layer has an accompanying database identifying the central and salient characteristics of all of the features located on the GIS map. The dams layer, for example, has an accompanying database that includes the year of construction, the size, the holding capacity, and many other features.

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California Has:

172,000 miles of rivers
70,000 miles of river downstream from dams
13,631 miles rated by the CARA PJA
1,483 miles rated "Outstanding" for aquatic
1,287 rated "Limited" for aquatic
1,379 miles rated "Outstanding" for riparian
1,828 miles rated "Limited" for riparian
24,500 miles assessed by SWRCB
2,616 miles "non-supporting"
68,814 CEQA projects since 1982
Over 1,500 restoration projects underway
713 rivers in 220 cities
1000's of Rivers Facts at

http://endeavor.des.ucdavis.edu/newcara/

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CARA’s Decision Support

From the beginning, the members of the CARA Steering Committee and the CARA Technical Advisory Committee argued forcefully that to best serve the diverse information needs of California rivers and riparian communities of interest, a vast distributed information system should be assembled. The other proposed alternative was to assess a one-time judgement of the condition of California's rivers, a practice that had precedent in twenty other states. The CARA advisory team vision proved successful for California. Many uses have benefited from interaction with the CARA system. A sampling of agency and organization efforts designed around or supported by CARA include the development of a system for identifying targets for riparian habitat conservation, the support of data storage and analysis affecting various sections of the Federal Clean Water Act, the development of the California Clean Water Action Plan, and the innovative designs for Caltrans’ Nonpoint Source Stormwater Runoff Prediction experiments. Others are shown in the table on the adjoining page.

In the Beginning

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dedicated to the analysis and management of California's rivers.
Hundreds of people from dozens of agencies, organizations, and programs have generously donated time and data to the California Rivers Assessment effort. The process would not have gotten started without the original impetus from California Resources Agency Secretary Douglas Wheeler, Wildlife Conservation Board Executive Officer John Schmidt, and the executive members of the California Biodiversity Council. Other individuals, too numerous to mention, have participated. The following organizations generously contributed staff and data to the CARA process: California Department of Conservation; California Department of Fish and Game; California Department of Forestry; California Department of Parks and Recreation; California Department of Water Resources; California Division of Mines and Geology; California Farm Bureau Federation; California State University, Chico; California State University, Humboldt; California Resources Agency; California Trout; California Wildlife Conservation Board; County Supervisors Association of California; Friends of the River; National Park Service Rivers and Trails Conservation Assistance Program; Natural Heritage Institute; Natural Resources Conservation Service; Pacific Gas and Electric; State Coastal Conservancy; State Lands Commission; State Water Resources Control Board; The Nature Conservancy; The Trust for Public Land; University of California, Davis; U.S. Army Corps of Engineers; U.S. Environmental Protection Agency; U.S. Bureau of Land Management; and the U.S. Bureau of Reclamation and numerous local watershed coalitions.

CARA Steering Committee

Scott Clemons
CARA Steering Committee Chair
Wildlife Conservation Board

Lyann Comrack
California Dept. of Fish and Game

Jim Decker
Bureau of Land Management

Terry Fleming
U.S. EPA

Polly Hays
U.S. Forest Service

Mietek Kolipinski
National Park Service

Mike McCoy
University of California, Davis

Melissa Miller-Henson
California Resources Agency

Jim Quinn
University of California, Davis

Janine Stenback
California Resources Agency

Paul Veisz
California Dept. of Fish and Game

Karen Beardsley Willett
University of California, Davis
# CARA Informs Environmental Decisions

<table>
<thead>
<tr>
<th>Decision Process</th>
<th>Participants</th>
<th>CARA Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Riparian Evaluation System</td>
<td>California Wildlife Conservation Board</td>
<td>GIS expert system based on CARA data to evaluate priority sites for riparian conservation.</td>
</tr>
<tr>
<td>Geospatial Water Body System</td>
<td>US EPA, State Water Resources Control Board, California Department of Forestry and Fire Protection</td>
<td>GIS and database system based on CARA data to more accurately conduct water-body assessments, as mandated by the National Clean Water Act.</td>
</tr>
<tr>
<td>California Clean Water Action Plan</td>
<td>Natural Resource Conservation Service and over 30 partner organizations</td>
<td>GIS system and database system based on CARA for prioritizing California Watersheds to qualify for Federal management and restoration funds.</td>
</tr>
<tr>
<td>Source Water Assessment Program</td>
<td>California Department of Health Services</td>
<td>GIS and field expert system for identifying threats to California's developed groundwater systems. Builds on CARA mapping system and CARA interactive World Wide Web mapping innovations.</td>
</tr>
<tr>
<td>Non-point Source Runoff Prediction</td>
<td>California Department of Transportation</td>
<td>GIS and computer model using CARA data and field observations to predict contributions to river sediment load from various land uses, a critical program for future TMDL assessment in California.</td>
</tr>
<tr>
<td>Individual Internet Uses</td>
<td>Watershed groups and members of the public at large</td>
<td>Over 1,400 individuals from non-governmental computer sites visit the CARA web every week. We know that many of these users are members of watershed groups, cooperative resource management planning groups, educational groups, and commercial and environmental organizations interested in the betterment of watersheds where they live or work.</td>
</tr>
</tbody>
</table>
CARA Information Infrastructure

The agencies, organizations, and individuals involved in the formation of CARA wanted it to be clear that they were interested in all of California's flowing waters. The first order of business was to find a common method for referencing each mile of every California river, stream, and creek.

US. EPA had begun such a system, but it needed substantial work. A consortium of CARA partners, led by the California Department of Fish and Game, set out to adopt the U.S. EPA Reach File 3 as the backbone of the CARA system. Reach File 3 provided a ready reference to index all sorts of information related to segments of rivers. For example, a segment of a river could have a data field attached to it indicating adjacent land uses, resident fishes, or sediment loads. The CARA system also adopted the USGS Hydrologic Unit Code system to characterize large watersheds and the Cal Water system to characterize moderate and small basins. These systems had the advantage of attributing broadly defined information across many water bodies. All of CARA's spatially distributed data was eventually related either to the U.S. EPA Reach File 3, the USGS Hydrologic Unit Code system, or to Cal Water watersheds. With all of the CARA systems data registered to one type of hydrologic feature or another, it became possible to develop GIS tools to inform particular interests in conservation, restoration, policy formation, and other decision processes.

The CARA Web

River data must be stored in a relevant infrastructure like the Reach File or Hydrologic Unit system to be informative. It also must have an accessible delivery system in order to be useful. The CARA data system is available via World Wide Web to anyone with internet access. The site is organized by hydrologic unit, and contains a myriad of facts about every one of California's 149 USGS Hydrologic Units. Most of the information contained on this Web site was available in one way or another before CARA, but it had never been brought together or organized to reflect waterbody and watershed characteristics and conditions. All of the data on the CARA web was first dissected by hydrologic unit boundaries or Cal Water unit boundaries or attached to Reach File 3. It was reformatted in a database that indexed all of the data by watershed and/or river. The CARA data is served to the public over the internet in this referenced format.

The Cara Web is used by over 2,000 visitors per week.
ICE MAPS

Tables of data are made more informative by the spatial indexing CARA provides on its World Wide Web database site. But there are limits to the usefulness of even a well indexed table of spatial data. The spatial relationship of elements, the degree of overlap of features, the relative abundance of habitat types, and many other concepts are best portrayed with maps. In 1994, CARA provided one of the first interactive user defined map generation applications on the internet. Using programming tools considered primitive by today's standards, CARA programmers crafted a product that allowed internet users to make maps of themes of their choosing in regions of their choosing. The product was called ICE_MAPS 1. In 1997, CARA programmers recreated this product with newly available tools. Many more features were incorporated, giving internet users an interface to map browsing and map making that is similar to having a GIS program fully loaded with river-related data on the user’s local machine. This program has proven very popular with over 2,000 user accesses per week.

CARA DATA

(Continued from page 1) Features of each of California’s 1,427 jurisdictional dams. Tabular data includes the huge “Storet” US EPA water-quality database, DWR flow data, Moyle Fish Count tables, and many others. References link to local data from city and county Governments, watershed groups and regional and state bodies.

FUNDING

Core funding for the California Rivers Assessment was provided by California Wildlife Conservation Board ($625,000), U.S. EPA Region IX ($150,000), the National Park Service Rivers Trails and Conservation Assistance Program ($15,000), and the U.S. EPA Center for Ecological Health Research at UC Davis ($120,000). These funds supported the people needed for interagency collaborative work; created the CARA data framework; produced, managed, and analyzed a Professional Judgement Assessment; collected and revised the diverse data holdings of dozens of institutions into a common format; developed the CARA World Wide Web site; and provided for the internet interactive map products ICE_MAPS 1 and ICE_MAPS (Continued on page 6)

ICE MAPS are made by over 300 visitors per week.
Additional funding was granted to UC Davis by many other sources for the additional collection of associated data supporting the CARA system or for the development of focused decision-support applications using CARA data. These focused projects, while funded separately from CARA, are a part of the CARA legacy. These projects are discussed in the “Decision Support” article on page 4 of this report. They include the projects in the table below.

<table>
<thead>
<tr>
<th>Organization(s)</th>
<th>Project</th>
<th>Funding</th>
</tr>
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<tbody>
<tr>
<td>US EPA, State Water Resources Control Board, California Department of Forestry and Fire Protection</td>
<td>Geospatial Water Body System</td>
<td>$180,000</td>
</tr>
<tr>
<td>California Biodiversity Council, California Department of Conservation, California Department of Fish and Game, California State Water Resources Control Board, U.S. Bureau of Land Management, U.S. Environmental Protection Agency</td>
<td>Natural Resources Project Inventories</td>
<td>$175,000</td>
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<tr>
<td>U.S. Fish and Wildlife Service</td>
<td>Incorporation of Klamath River Information System</td>
<td>$17,000</td>
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<tr>
<td>U.S. Environmental Protection Agency</td>
<td>CEHR Border Rivers Water Quality Assessment</td>
<td>$150,000</td>
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<tr>
<td>U.S. Environmental Protection Agency, U.S. Geological Survey, Cal Trout</td>
<td>California Reach File 3 Final Processing</td>
<td>$190,000</td>
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<tr>
<td>California Department of Transportation</td>
<td>North Coast River Loading Study</td>
<td>$247,000</td>
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<tr>
<td>National Park Service</td>
<td>Verification of Biological Inventory Database in California National Parks</td>
<td>$15,000</td>
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<tr>
<td>USGS - Biological Resources Division</td>
<td>Coastal Salmon Data Catalog</td>
<td>$30,000</td>
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<tr>
<td>USGS - Biological Resources Division</td>
<td>Coastal GIS Catalog</td>
<td>$15,000</td>
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<tr>
<td>California Department of Forestry</td>
<td>Public Access -- Sierra Nevada Ecosystem Project Data</td>
<td>$45,000</td>
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<tr>
<td>California State Water Resources Control Board</td>
<td>Non-point Source Mitigation Measures, Practices and Authorities</td>
<td>$165,000</td>
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</table>

CARA generated an additional $1.25 million in related research from 1995-1998.
CARA distributed a questionnaire to more than 1000 individuals in 375 public agencies and private organizations in two massive distribution efforts, two years apart. The PJA questionnaire sought information in seven categories. The Professional Judgment Assessment succeeded in collecting information for 616 segments on 145 rivers.

Each piece of information received was geographically coded using both the U.S. Geological Survey’s Hydrologic Unit Code and the Environmental Protection Agency’s River Reach File system. This coded data was then entered into CARA’s PJA database. Because of its unique code or “address,” each piece of river-related information is electronically

(Continued on page 8)
The PJA

(Continued from page 7)
linked to its particular river and watershed location. An evaluation of this data was developed by the CARA steering committee with assistance from project staff. A set of criteria using a list of "indicator" responses to the survey questions most frequently answered was developed. Rivers were scored based on these criteria. For presentation purposes, the scores were distributed into four groups: "Outstanding," "Substantial," "Moderate," or "Limited."

A second survey instrument was distributed. It was developed by the Bureau of Land Management in conjunction with the Natural Resource Conservation Service and the U.S. Forest Service. This instrument was designed to measure the functionality of riparian ecosystems.

### PJA Results

<table>
<thead>
<tr>
<th></th>
<th>Total Sought</th>
<th>Outstanding</th>
<th>Substantial</th>
<th>Moderate</th>
<th>Limited</th>
<th>No Information</th>
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<tbody>
<tr>
<td></td>
<td>Miles</td>
<td>%</td>
<td>miles</td>
<td>%</td>
<td>miles</td>
<td>%</td>
</tr>
<tr>
<td>PJA Aquatic</td>
<td>13,631</td>
<td>100%</td>
<td>1,483</td>
<td>11%</td>
<td>2,911</td>
<td>21%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2,643</td>
<td>19%</td>
<td>1,287</td>
<td>9%</td>
</tr>
<tr>
<td>PJA Riparian</td>
<td>13,631</td>
<td>100%</td>
<td>1,379</td>
<td>10%</td>
<td>3,150</td>
<td>23%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2,120</td>
<td>16%</td>
<td>1,828</td>
<td>13%</td>
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<tr>
<td></td>
<td></td>
<td>Proper Functioning</td>
<td>Functioning at Risk</td>
<td>Non-Functional</td>
<td></td>
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<tr>
<td>PFC</td>
<td>1,111</td>
<td>33%</td>
<td>1,757</td>
<td>52%</td>
<td>499</td>
<td>15%</td>
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