Using Indicators to Measure Watershed Health

Environmental, economic, and social indicators are used world-wide to report the status and trends in condition of human and natural systems. The types of indicators chosen vary depending on what is being measured and on the audience or decision-making process targeted for reporting. The National Research Council identified two types of frameworks: those that measure the status of the system, and those that seek to identify cause and effect relationships. Many contemporary indicator frameworks incorporate both condition indicators and indicators of influences, allowing for both a condition assessment and an evaluation of what may be affecting condition. This reflects a common aspect of these frameworks – that they are practical and intended to support restoration, regulatory, or sustainability decision-making. Together these approaches allow for evaluation and reporting on system attributes that reflect the goals of watershed and regional residents and stakeholders.

What are Watershed Goals?

Stakeholders in the Feather River Watershed have goals for different services of the watershed. Goals and objectives were collected from stakeholder organizations and their planning documents and were used to select and evaluate indicators.

- Maintain and improve water quality and supply to sustainably meet the needs of natural and human communities
- Protect and enhance native aquatic and terrestrial species, especially sensitive and at-risk species and natural communities
- Protect and enhance landscape and habitats structure and processes to benefit ecosystem and watershed functions
- Maintain and restore natural disturbance processes that balance benefits for natural and human communities
- Maintain and improve the social and economic conditions, including benefits from healthy watersheds
A Roadmap for the Future (Roadmap) and Watershed Health Indicators Program (WHIP). Roadmap provides an overview of the basin’s six subregions and a picture of watershed health within the Sacramento River Basin. WHIP uses the Watershed Assessment Framework (WAF) to better understand some of the relationships between social, economic, and environmental conditions, and watershed management actions. SRWP launched the WHIP Report Card effort in 2008, focusing on the Feather River Watershed for the first evaluation. A similar evaluation of the basin’s other subregions will be beneficial to track current watershed conditions and trends.
Method for Evaluation

Each indicator was evaluated for how well it met the target for the particular indicator. For example, the water quality indicator “water temperature” was evaluated according to standards for early life-stages of native fish species (i.e., salmon and trout). The “distance to target/reference” for each indicator was converted to a 0 (poor) to 100 (good) scale. The values for each indicator were then averaged for each goal and objective and expressed for each subwatershed. Trends in condition were calculated for indicators where data were available for more than 2 or 3 years. Confidence in the expression of average condition and trends findings were a combination of quantitative assessments of variability within and among subwatersheds, significance of trends assessments, and how representative the indicator is of the system.

<table>
<thead>
<tr>
<th>Goals</th>
<th>Measurable Objective</th>
<th>Indicators</th>
<th>EBNFF</th>
<th>NFF</th>
<th>MP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality and supply for natural and human communities</td>
<td>Water quality for aquatic health</td>
<td>Water temperature, algae, mercury in fish</td>
<td>73</td>
<td>75</td>
<td>38</td>
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<tr>
<td></td>
<td>Maintain natural stream flows</td>
<td>Current flow vs. historical flow</td>
<td>69</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>Protect and restore native animals and plants</td>
<td>Native birds</td>
<td>Bird species richness</td>
<td>100</td>
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<tr>
<td></td>
<td>Protect native aquatic communities</td>
<td>Land disturbance, aquatic insects, fish</td>
<td>69</td>
<td>64</td>
<td>69</td>
</tr>
<tr>
<td>Protect and enhance habitats, ecosystems, and watersheds</td>
<td>Protect aquatic connections</td>
<td>Barriers to aquatic organism movement</td>
<td>77</td>
<td>82</td>
<td>76</td>
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<tr>
<td></td>
<td>Protect landscape connections</td>
<td>Barriers to wildlife movement</td>
<td>23</td>
<td>81</td>
<td>44</td>
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<tr>
<td></td>
<td>Maintain natural production and nutrient cycles</td>
<td>Carbon storage and sequestration, nitrogen loads</td>
<td>88</td>
<td>93</td>
<td>63</td>
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<tr>
<td>Maintain and restore natural disturbance</td>
<td>Restore natural fire regimes</td>
<td>Fire frequencies compared to expected frequency</td>
<td>2</td>
<td>9</td>
<td>14</td>
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<tr>
<td></td>
<td>Encourage natural flooding, while protecting people</td>
<td>Floodplain access</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>Improve social and economic conditions &amp; benefits from healthy watersheds</td>
<td>Enhance wildlife-friendly agriculture</td>
<td>Pesticide use and organic agriculture</td>
<td>100</td>
<td>99</td>
<td>100</td>
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<tr>
<td></td>
<td>Improve community economic status</td>
<td>Poverty measure</td>
<td>49</td>
<td>52</td>
<td>54</td>
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</tbody>
</table>
### Feather River Report Card

Each subwatershed was evaluated for its condition relative to targets for each indicator. The subwatersheds are:

- **EBNFF** – East Branch North Fork Feather
- **NFF** – North Fork Feather
- **MFF** – Middle Fork Feather
- **LF** – Lower Feather
- **NY** – North Yuba
- **MY** – Middle Yuba
- **SY** – South Yuba
- **DC** – Deer Creek
- **LY** – Lower Yuba
- **UB** – Upper Bear
- **LB** – Lower Bear.

Trend is evaluated from a combination of trend assessments from each subwatershed. Confidence refers to quantitative or professional assessment of confidence in the result. For more information, visit [www.sacriver.org](http://www.sacriver.org).

### Condition Score (0 – 100)

<table>
<thead>
<tr>
<th>TF</th>
<th>LF</th>
<th>NY</th>
<th>MY</th>
<th>SY</th>
<th>DC</th>
<th>LY</th>
<th>UB</th>
<th>LB</th>
<th>Trend</th>
<th>Confidence</th>
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<td>47</td>
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<td>35</td>
<td>13</td>
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<tr>
<td>a</td>
<td>54</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>63</td>
<td>40</td>
<td>60</td>
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<td>100</td>
<td>100</td>
<td>100</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>➡️</td>
<td>medium</td>
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<tr>
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<td>69</td>
<td>62</td>
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<td>69</td>
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<td>70</td>
<td>61</td>
<td>➡️</td>
<td>high</td>
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</tbody>
</table>
Feather River Watershed
Subwatersheds and counties

Subwatersheds:
- Deer Creek (DC)
- East North Fork Feather (ENFF)
- Lower Bear (LB)
- Lower Feather (LF)
- Lower Yuba (LY)
- Middle Fork Feather (MFF)
- Middle Yuba (MY)
- North Fork Feather (NFF)
- North Yuba (NY)
- South Yuba (SY)
- Upper Bear (UB)

Counties:
- Shasta
- Butte
- Sierra
- Nevada
- Plumas
- Sutter
- Yuba
- Placer
Report Card Findings

Environmental and community conditions are highly variable across the Feather River Watershed and across goals and indicators of condition. Bird populations appear to be doing very well and fire patterns are quite different than they should be. Aquatic communities are struggling in almost all subwatersheds, possibly due to the combination of water and land management that characterizes this watershed. Trends in most cases are either unknown or not detectably changing. Economic condition and carbon sequestration rates are declining, but agricultural practices are improving. Overall, the Feather River Watershed is in fair condition with room for improvement.

Report Card Technical Report

The technical report provides more detail on the watershed, individual indicators, and the methods used to make the findings. It is also viewable on our website: [http://www.sacriver.org](http://www.sacriver.org).
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