Making an Economic Case for Resilience
Practical Applications in California
Earth Economics

• 501 (c)(3) non-profit

• Founded 1998

• 18 Staff
Natural Capital
Adds Real Economic Value
Figure 1. Track of Hurricane Katrina, August 23-29, 2005, showing spatial extent and storm intensity along its path (source: NOAA)
$200 Billion in Damages

1,600 People Died
Gaining Ground

Wetlands, Hurricanes and the Economy:
The Value of Restoring the Mississippi River Delta

Earth Economics
Vegetation density around at diversions in four diversions scenario at Year 50
CPRA $50 Billion Plan

Atchafalaya River Outflow

Mississippi River Outflow
The big picture

What's of value here?
Four Types of Capital

Financial Capital
Built Capital
Social Capital
Human Capital
Natural Capital
Ecosystem Services
The benefits people derive from nature

Natural Capital Asset: Watershed
Function: Collection & Filtration
Service: Water Supply
Types of Maps

✓ Provisioning
  - Water Supply
  - Cultural Value
  - Waste treatment/removal
  - Flood protection
  - Coastal flood protection

✓ Beneficiaries
  - Aesthetic value
  - Sediment flows
  - Wildlife/biodiversity
  - Recreation

✓ Impairments
  - Over consumption
  - Sewerage
  - Salinization
  - Water pollution
  - Impervious surfaces
Goods Provisioning

Water Supply

Food

Timber

Fuel

Fiber

Medicinal Resources
Regulating Services

- Flood Protection
- Water Quality/Filtration
- Water Temperature
- Hydrological Functions
- Soil Erosion Control
- Gas & Climate Stability
- Biological Control
- Soil Formation
Supporting Services

- Biodiversity and Habitat
- Nutrient Cycling
- Pollination
- Net Primary Production
Cultural Services

Aesthetic

Recreation

Spiritual & historic

Science & education
Conventional Framework

ENVIRONMENT + FLOOD MITIGATION + ECONOMY

CAPITAL INVESTMENT OPERATIONAL COSTS
Holistic Analysis

ENVIRONMENT
- Flood Mitigation
- Salmon Habitat
- Water Quality
- Water Supply
- Air Quality

SOCIETY
- Climate Resilience
- Equity
- Public Health
- Recreation
- Social Cohesion

ECONOMY
- Capital Investment
- Operational Costs
- Jobs
- Property Values
- Avoided Damages
Including ecosystem services and other co-benefits nearly doubled the total benefit amount.

- **PROJECT COSTS**: $5.4MM
- **TRADITIONAL BENEFITS**: up to $3.6MM
- **ADDITIONAL BENEFITS**: up to $3.2MM
Financing Solutions
<table>
<thead>
<tr>
<th>Co-Benefit</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster Risk Reduction</td>
<td>FEMA; Pre-Disaster Mitigation Grant Program; Insurance Industry</td>
</tr>
<tr>
<td>Water Quality &amp; Supply</td>
<td>Local Rates; GASB 62 &amp; Green Bond Financing; Power company</td>
</tr>
<tr>
<td>Economic Uplift and Community Development</td>
<td>HUD; Foundation PRIs</td>
</tr>
<tr>
<td>Carbon Sequestration</td>
<td>AB32</td>
</tr>
</tbody>
</table>
I. TITLE:

Consideration of Environmental Benefits in the Evaluation of Acquisition Projects under the Hazard Mitigation Assistance (HMA) Programs

II. DATE OF ISSUANCE:

JUN 1 & 2013

III. POLICY STATEMENT:

FEMA will allow the inclusion of environmental benefits in benefit-cost analyses (BCA) to determine cost effectiveness of acquisition projects.

IV. PURPOSE:

The purpose of this policy is to identify and quantify the types of environmental benefits that FEMA will consider in the BCA for acquisition projects.
Table I shows the types and values of environmental benefits included in the BCA for acquisition-demolition or acquisition-relocation projects:

Table I: Annual Estimated Monetary Benefits per Acre per Year

<table>
<thead>
<tr>
<th>Environmental Benefit</th>
<th>Green Open Space</th>
<th>Riparian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Value</td>
<td>$1,623</td>
<td>$582</td>
</tr>
<tr>
<td>Air Quality</td>
<td>$204</td>
<td>$215</td>
</tr>
<tr>
<td>Biological Control</td>
<td>--</td>
<td>$164</td>
</tr>
<tr>
<td>Climate Regulation</td>
<td>$13</td>
<td>$204</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>$65</td>
<td>$11,447</td>
</tr>
<tr>
<td>Flood Hazard Reduction</td>
<td>--</td>
<td>$4,007</td>
</tr>
<tr>
<td>Food Provisioning</td>
<td>--</td>
<td>$609</td>
</tr>
<tr>
<td>Habitat</td>
<td>--</td>
<td>$835</td>
</tr>
<tr>
<td>Pollination</td>
<td>$290</td>
<td>--</td>
</tr>
<tr>
<td>Recreation/Tourism</td>
<td>$5,365</td>
<td>$15,178</td>
</tr>
<tr>
<td>Storm Water Retention</td>
<td>$293</td>
<td>--</td>
</tr>
<tr>
<td>Water Filtration</td>
<td>--</td>
<td>$4,252</td>
</tr>
<tr>
<td><strong>Total Estimated Benefits</strong></td>
<td><strong>$7,853</strong></td>
<td><strong>$37,493</strong></td>
</tr>
</tbody>
</table>

Table II shows total estimated benefits per acre per year and the total estimated benefits per-square-foot for green open space and riparian land use; the benefits can accrue for any lot size.
# Rim Fire Damages: Environmental Benefits

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td>$30,569,395</td>
<td>$69,202,212</td>
</tr>
<tr>
<td>Herbaceous Wetland</td>
<td>$515,158</td>
<td>$20,284,851</td>
</tr>
<tr>
<td>Lake</td>
<td>$93,926</td>
<td>$2,877,038</td>
</tr>
<tr>
<td>Riparian</td>
<td>$47,071</td>
<td>$325,824</td>
</tr>
<tr>
<td>River</td>
<td>$4,073</td>
<td>$907,523</td>
</tr>
<tr>
<td>Shrub</td>
<td>$541,959</td>
<td>$37,247,933</td>
</tr>
<tr>
<td>Forest Broad Leaf</td>
<td>$5,098,191</td>
<td>$284,804,356</td>
</tr>
<tr>
<td>Forest Coniferous</td>
<td>$63,147,300</td>
<td>$320,363,902</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$100,017,074</strong></td>
<td><strong>$736,013,639</strong></td>
</tr>
</tbody>
</table>
National Disaster Resilience Competition
CDBG-NDR
U.S. Department of Housing and Urban Development
May 12, 2016

MEMORANDUM FOR: Mitigation Division Directors
FEMA Regions I-X

FROM: Michael M. Grimm
Assistant Administrator for Mitigation
Federal Insurance and Mitigation Administration

SUBJECT: Benefit Cost Analysis Tools for Drought, Ecosystem Services, and Post-Wildfire Mitigation for Hazard Mitigation Assistance

In September 2015, FEMA released three new activities eligible for the Hazard Mitigation Assistance (HMA) programs: Aquifer Storage and Recovery, Floodplain and Stream Restoration, and Flood Diversion and Storage, known as the Climate Resilient Mitigation Activities (CRMA). These activities can be used for any hazard when appropriate and leverage traditional risk reduction benefits and applicable ecosystem services. Additionally, FEMA developed pre-calculated benefits for cost effectiveness evaluation of soil stabilization, flood diversion, and reforestation projects in wildfire impacted areas to support expedient implementation of post-wildfire mitigation actions. With this memorandum, FEMA is releasing the following additions
OFF THE BURN
IT'S NATURE'S TURN
Measure Q: $120 million
New Partners: Healthcare
### Outcomes for asthma; 100 units over 10 years

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Monetizable Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Visits</td>
<td>$95,000 in out-of-pocket</td>
</tr>
<tr>
<td>Missed Work Wages</td>
<td>$270,000 earned</td>
</tr>
<tr>
<td>Disutility</td>
<td>$1.3M WTP</td>
</tr>
<tr>
<td>Medicaid ED Visits</td>
<td>$290,000 savings</td>
</tr>
<tr>
<td>Employment Productivity</td>
<td>$165,000 in production</td>
</tr>
<tr>
<td>School District Cost</td>
<td>$27,000 school funds</td>
</tr>
<tr>
<td>Medicaid ED Visits</td>
<td>$195,000 avoided loss</td>
</tr>
<tr>
<td>Child Hospitalizations</td>
<td>$203,000 avoided cost</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>$65,000 cost savings</td>
</tr>
</tbody>
</table>
Outcomes from affordability and increased stability of housing
100 units over 10 years

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Monetizable Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent Alleviation</td>
<td>$800K Expenditures in Hospitals</td>
</tr>
<tr>
<td>Lifetime Income boost</td>
<td>$10 Million</td>
</tr>
<tr>
<td>Food Quality</td>
<td>$150K per child</td>
</tr>
<tr>
<td>Child Education Spending</td>
<td>$1 Million</td>
</tr>
<tr>
<td>Jobs from Construction</td>
<td>$1 Million</td>
</tr>
<tr>
<td>Medicaid visits homeless</td>
<td>$46,000</td>
</tr>
<tr>
<td>Taxes</td>
<td>$1.32 multiplier for output</td>
</tr>
<tr>
<td>Medicaid ED Visits</td>
<td>$25 Million</td>
</tr>
<tr>
<td>Community Reputation</td>
<td>$185 million appraisal increase</td>
</tr>
<tr>
<td>Readmission Visits homeless</td>
<td>Maintain reimbursement</td>
</tr>
</tbody>
</table>

$2.4 Million from total expenditures

2475 fewer visits

5% to 10% appraisal value increase

15% decrease
Accounting: What’s the Problem?

Your finance folks tell you that you can only pay for these things out of annual operating cash…

…but annual rate revenue is not sufficient to cover large scale investments.

There is an alternative financing choice available that water agencies are often unfamiliar with.
Green Roofs

Stormwater treatment
Lower utility bills
Cooler cities
Cleaner air
Neighborhood beautification
Green infrastructure: other examples

- Efficiency Investment Programs
- Recycling and Water Reuse Programs
- Green Infrastructure and Nature-Based Solutions
What’s the Solution?
What’s the Solution?

GASB 62 says an entity with rate setting ability can capitalize ‘business-type activity costs’ that would otherwise be expensed.

Implementation guidance will clarify this in April-May 2018.
Urban Trees

- Stormwater management
- Lower asthma rates
- Cooler cities
- Better quality of life
- Walkable cities
Who is Doing this Now?

Seattle and King County

Los Angeles
QUESTIONS?