Working with Nature Across the Land-use Spectrum
A Holistic Approach to Ecological Resilience

NEP Technical Transfer Conference
4 October 2018
beach and marsh at Albany Hill
now
now
now
Our landscapes were altered with little attention to natural processes
...resulting in challenges now and in the future
Transforming our cities and landscapes into ecologically resilient systems is both necessary and possible.
Where we work

- Natural areas & working landscapes
- Natural & urban waterways
- Urban greening & biodiversity
- Estuaries & shoreline
What We Do

Science: Draw on cutting-edge science from across disciplines

Translation: Turn science into usable local guidance, visions, tools

Implementation: Facilitate integrated actions via partnerships and planning
Challenge and Opportunity

- Diverse range of benefits often presumed but not scientifically guided
- No systematic approach to assure benefits, maximize value of coordinated investments, minimize negative effects
- Little guidance about how to integrate available to agencies, landowners, designers, and planners
- Need overarching, multi-benefit plan at the scale of the system
- Can consolidate funding from multiple sources with differing goals
WORKING WITH NATURE across the land-use spectrum
WORKING WITH NATURE across the land-use spectrum

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<tr>
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**WORKING WITH NATURE**
across the land-use spectrum

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Nature-Based Solutions

Habitat conservation and restoration
Emulate fire disturbance
Prevent development

Creek / wetland /floodplain restoration
Wildlife-friendly ag
Prevent development

Water capture
Carbon sequestration
Manage wildfire risk

Water quality benefits
Water infiltration
Flood risk management
Laguna de Santa Rosa
Sonoma County
Project Focus Area

Laguna 100-yr floodplain
### Nutrient Transport and Assimilation (Conceptual)

<table>
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<tr>
<th></th>
<th>Historical (ca. 1850)</th>
<th>Modern</th>
<th>Future (potential)</th>
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<td><strong>wet meadow</strong></td>
<td><img src="image1" alt="Diagram" /></td>
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<td><strong>valley freshwater marsh</strong></td>
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<td><strong>forested wetland and riparian forest/scrub</strong></td>
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Source: Baumgarten et al. 2017
## Working with Nature across the Land-use Spectrum

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NATURE and HUMAN HEALTH

Well-being and psychological health
Cognitive function

Access to biodiversity....

- Greater restorative benefit in urban park with high biodiversity
  - Fuller et al. 2007, Carrus et al. 2015
- Micro-biome rewilding may be greater with higher biodiversity
  - Immune system diseases - allergies, asthma, obesity, IBS
  - Flies et al. 2017
RE-OAKING SILICON VALLEY
Building Vibrant Cities with Nature
Benefits for biodiversity

Acorn Woodpecker
Oak titmouse
Mournful duskywing
California sister
Crab spider
More services for people

- More drought-tolerant
- Reduced water needs
- Natural heritage
- Reduce urban heat island
- Store more carbon
- Evergreen → runoff reduction
- More drought-tolerant
GreenPlan-IT: optimizing LID installations

- 30% runoff reduction
- 56% load reduction

Best option - Worse options

Optimal Bioretention Locations for 30% Runoff & 56% PCB Load Reduction
GreenPlan-IT: Wetland restoration planning for nutrient reduction

Building Capacity

- Reduce stormwater runoff and nutrient loads to Laguna de Santa Rosa
- Prioritize and identify watershed scale wetland restoration project sites
Healthy Watersheds Resilient Baylands (EPA WQIF)

- Integrate water quality benefits and ecological functions
- Identify where GI and urban forestry can synergistically achieve multiple benefits
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| **Resulting Ecosystem Services** | Water capture | Water quality benefits | Flood peak reduction | Shoreline protection |
| | Carbon sequestration | Water infiltration | Water quality benefits | Carbon sequestration |
| | Manage wildfire risk | Flood risk management | Sediment transport | Water quality benefits |

- Ecosystem Services:
  - Water capture
  - Carbon sequestration
  - Manage wildfire risk
  - Water quality benefits
  - Flood peak reduction
  - Shoreline protection
  - Water infiltration
  - Flood risk management
  - Sediment transport
  - Biodiversity
OPERATIONAL LANDSCAPE UNITS FOR SF BAY:
Using nature’s jurisdictions to plan for sea level rise

Funded by SF BAY RWQCB
Shoreline planning units based on physical processes
Nature-based Solutions

Low-crested oyster reef
Submerged vegetation
Mudflat augmentation
Marsh
Cobble beach
Sand beach
Shell hash beach

Polder management
Horizontal levee
Migration space preparation
+Creek to bay connections
+Green stormwater infrastructure
Submerged vegetation restoration
Oyster reef creation
Mudflat augmentation
Beach creation

Polder management
Tidal marsh restoration
Horizontal levee construction
Migration space preparation

Analysis in progress
Refinement needed
Refinement needed
Refinement needed

Analysis in progress
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<tr>
<th>Problem</th>
<th>Cause</th>
<th>Example measure</th>
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<td>Wave overtopping or erosion of levee with wide foreshore</td>
<td>Large waves reach levee</td>
<td>Marsh, fine beach, horizontal levee</td>
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<td>Close to deep water</td>
<td>Coarse beach</td>
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<td>Combined flooding</td>
<td>Loss of floodplain</td>
<td>Retention basins, setback levee</td>
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<td>Channel conveyance</td>
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<td>Loss of marsh area</td>
<td>Wave erosion of scarp</td>
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<td>Loss of elevation capital</td>
<td>Low accretion rate</td>
<td>Strategic placement</td>
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Richardson Bay

Opportunities Map

- Lack of migration space
- Low elevation capital
- Creek flooding
- Combined fluvial flooding

Legend:
- Low-created oyster reef creation
- Submerged vegetation restoration
- Marsh restoration:
  - Potential marsh needed for wave attenuation
  - Potential marsh
- Migration space preparation:
  - Developed migration space
  - Undeveloped and protected migration space
  - Undeveloped but not protected migration space
- Polder management
- Horizontal Levee

Opportunities Map
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Thank You