# Ecosystem Services and Ecosystem Restoration

## 4th National Conference on Ecosystem Restoration

**August 2nd, 2011**

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# Main points of my talk


- Restoration involves complex socio-ecological systems
- Restoration increasing in importance while public funding ($$$) is decreasing
- Demand for ecosystem services is growing
- Potential for aligning economic incentives with restoration goals
- Opportunities exist

# Parable: The scientist and the policymaker

# Ecosystem Services: Definition

**Ecological services are the benefits humans derive from ecosystems.**

Daily & Matson, PNAS, 2008

**Increasingly ecosystem services are seen as having economic value and something that can be traded in markets.**

Wainger & Boyd, 2006

# Ecosystem Services = Benefits to people

## Provisioning

- Food
- Fresh water
- Fuel wood
- Genetic resources

## Regulating

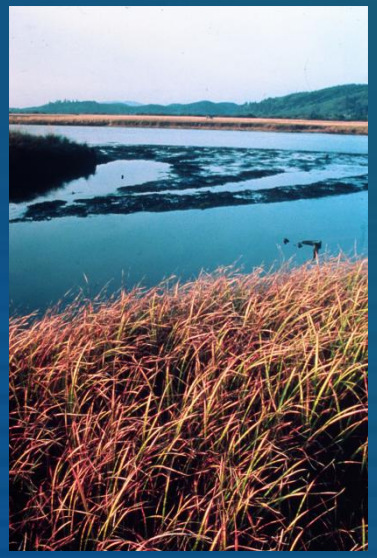
- Climate regulation
- Disease regulation
- Flood regulation

## Cultural

- Spiritual
- Recreational
- Aesthetic
- Educational

## Supporting

- Soil formation
- Nutrient cycling
- Primary production



# Pressure on ecosystems will grow

US population is rising to nearly 400 million by 2050 & world population to 9 billion

Today, US corn and soy prices are over twice their historical averages – threatening marginal lands

US is loosing about one million acres of farmland per year to development
(An area approximately the size of Maryland)

Several million additional acres will be developed for wind, solar, and natural gas in the US in the next 20 years

Climate change

# Pressure on funding

Restoration is/has been driven largely by public $$$

Public $$$ in decline and likely to be for the foreseeable future

Need to identify and mobilize new sources of $$$

Currently, wetland mitigation banks represent the largest source of private $$$

Advances in ecosystem services and practical experience from restoration projects offer lessons for federal policy-makers to expand use of private $$$ to achieve restoration objectives

# Ecosystem Restoration: Definition

**"Ecological restoration:**

**-- is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.**

**-- increases natural capital and the output of natural goods and services."**

SER, April 2004

# Restoration spending

- ~ $5.6B spent from 1995 to 2004 on restoring Chesapeake Bay, yet still described as “dangerously out of balance”

  2010 State of the Bay Report

- ~ $200M spent annually for California Bay Delta, yet still described as “becoming severely degraded”

  CalFed 2008 Implementation Report

- ~ $16B spent via Farm Bill from 2002 - 2007, yet still depleting top soil at an unsustainable rate and dead zone in Gulf of Mexico

  GAO, CRS

# Mitigation banking

~ 830 wetland and stream mitigation banks valued at $1.2B

~ $3.3B spent annually on wetland and stream mitigation

~ 134 habitat banks valued at approx. $370M/yr

~$4B allocated to Farm Bill conservation programs annually

~$3.5B spent on federal land mgmt. annually

# History: Wetland Mitigation Banking

**1972:** *Clean Water Act* is passed.

**1977:** Section 404(b)1 requires mitigation

**1989**: Bush administration pledges "No net loss" of wetlands

**1990:** "No net loss" becomes official federal policy

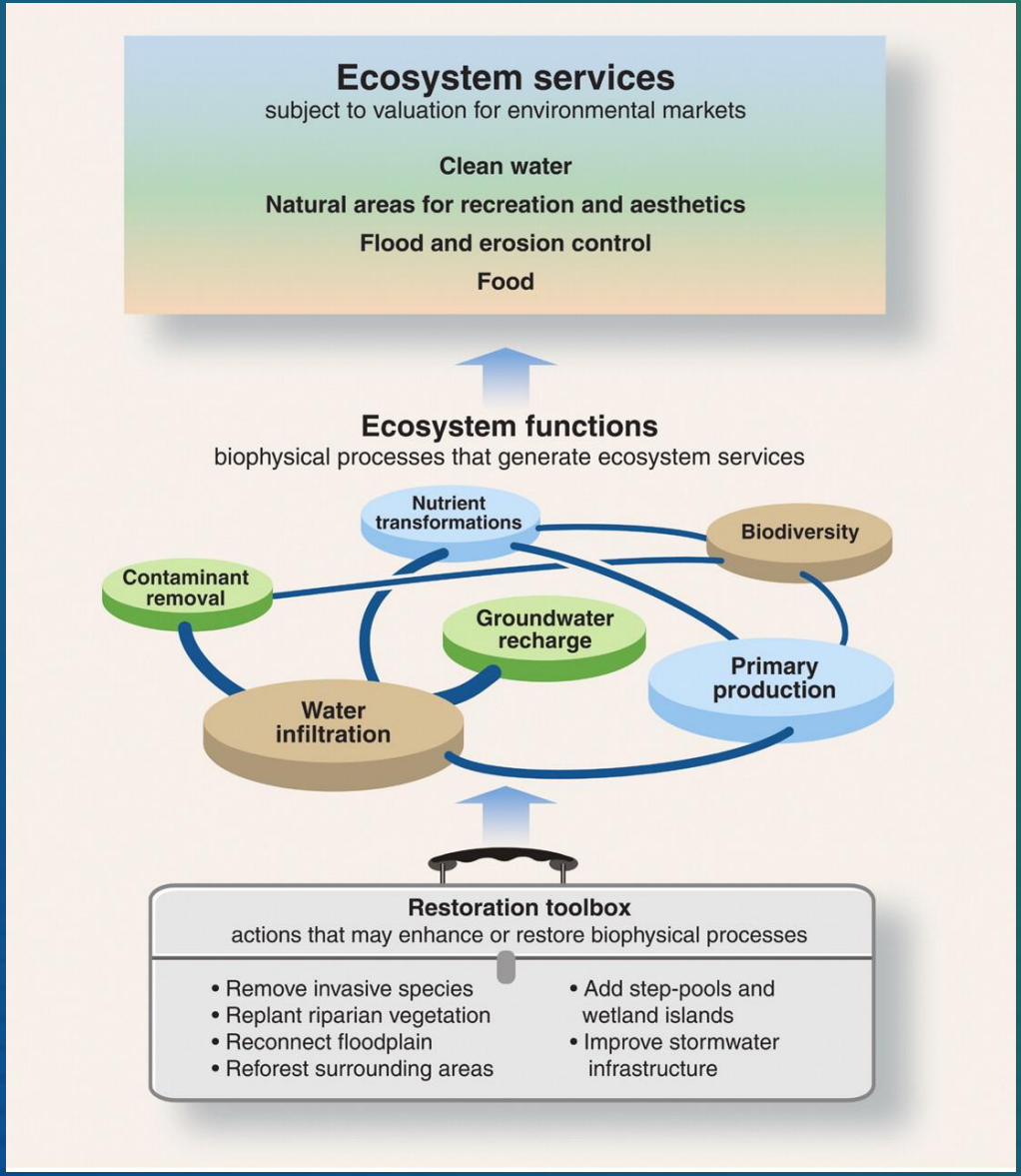
**1995:** *Federal Guidance for the Establishment, Use, and Operations of Mitigation Banks*

**2008:** *Final Compensatory Mitigation Rule*

# Restoration / mitigation funding

| Name of Program | Current Spending | Assumptions | Data Source |
|---|---|---|---|
| **Chesapeake Bay** | $ 558 | State and federal agencies provided ~$365.7 million direct funding and $192.6 million indirect funding per year from 1995-2004 | GAO study, Oct 2005 |
| **Puget Sound** | $ 564 | Est. annual spending on protection & restoration:<br>~ $564 million per year from the public sector | Puget Sound Partnership, Dec 2008 |
| **Gulf Coast** | $ 1,500 | Est. based on Coastal Protection and Restoration Authority FY2011 requested budget ($620 million) and the anticipated settlement from BP oil spill. | LA CPRA FY2011 Annual Plan |
| **Great Lakes** | $ 475 | NOAA & EPA budget to implement the President's Great Lakes Restoration Initiative (FY2010) | NOAA Website |
| **Bay Delta** | $ 196 | 2010 Enacted CALFED Funding | Bay-Delta FY2012 Budget Request |
| ***CWA 404:*** *Stream and Wetland Mitigation* | $ 3,000 | Est. FY07 stream and wetland mitigation spending:<br>~$3 billion per year; ~4% for streams<br>~40% of mitigation is done through mitigation banking. | ELI Report, Oct 2007. |
| ***ESA:*** *Conservation banks* | $ 370 | Estimated annualized commitment of funds to compensatory mitigation under ESA 2003-2006 | ELI and EDF Report, Feb 2008. |
| ***ESA:*** *Compliance costs* | $ 1,470 | FY2009 State and Federal Government ESA expenditures, | "2009 Expenditure Report" USFWS |
| **Farm Bill** Programs | $ 4,000 | Average of FY07 and FY08 Farm Bill conservation title spending | CRS |

# Restoration of ecosystem services



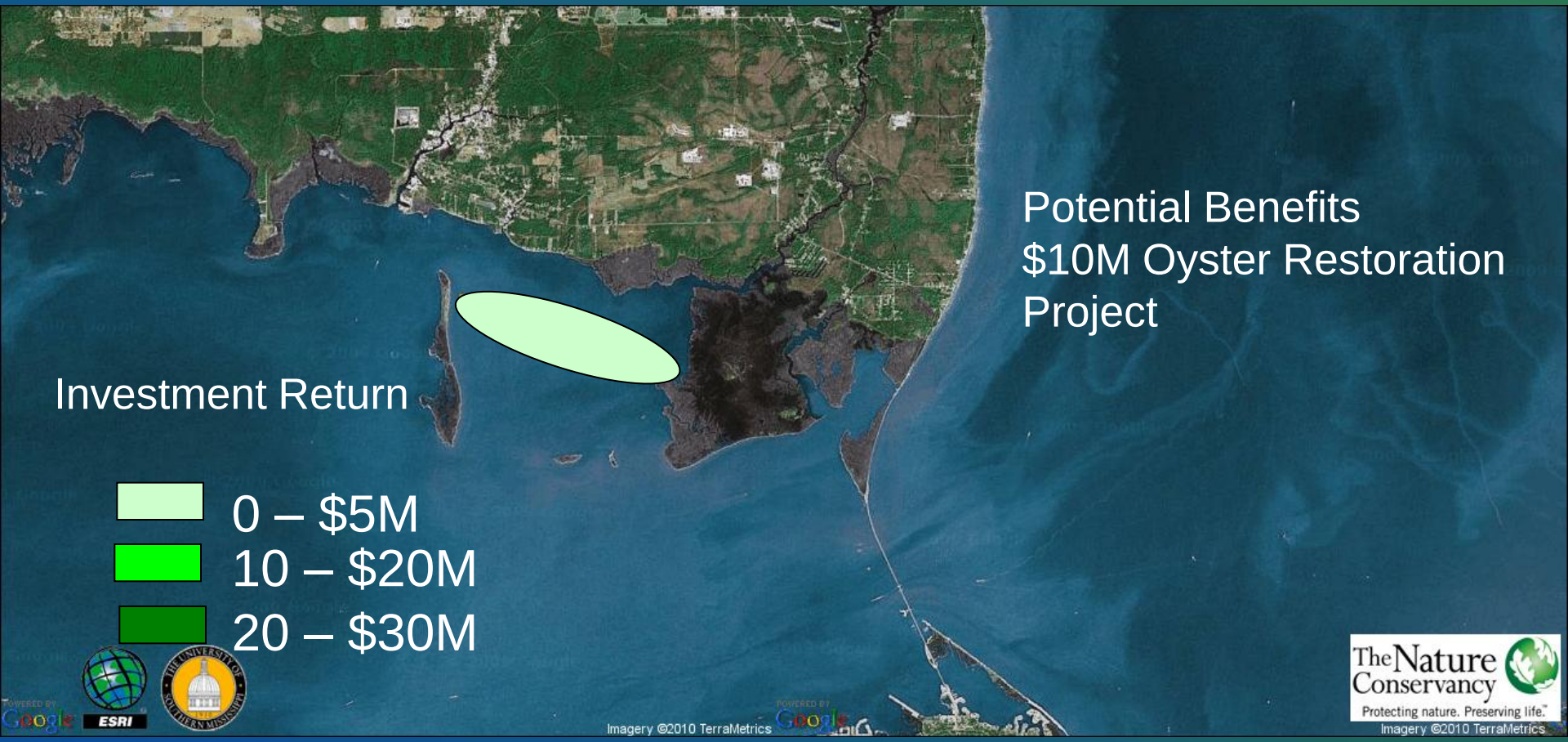

M A Palmer, S Filoso Science 2009;325:575-576

# An Example: Gulf of Mexico



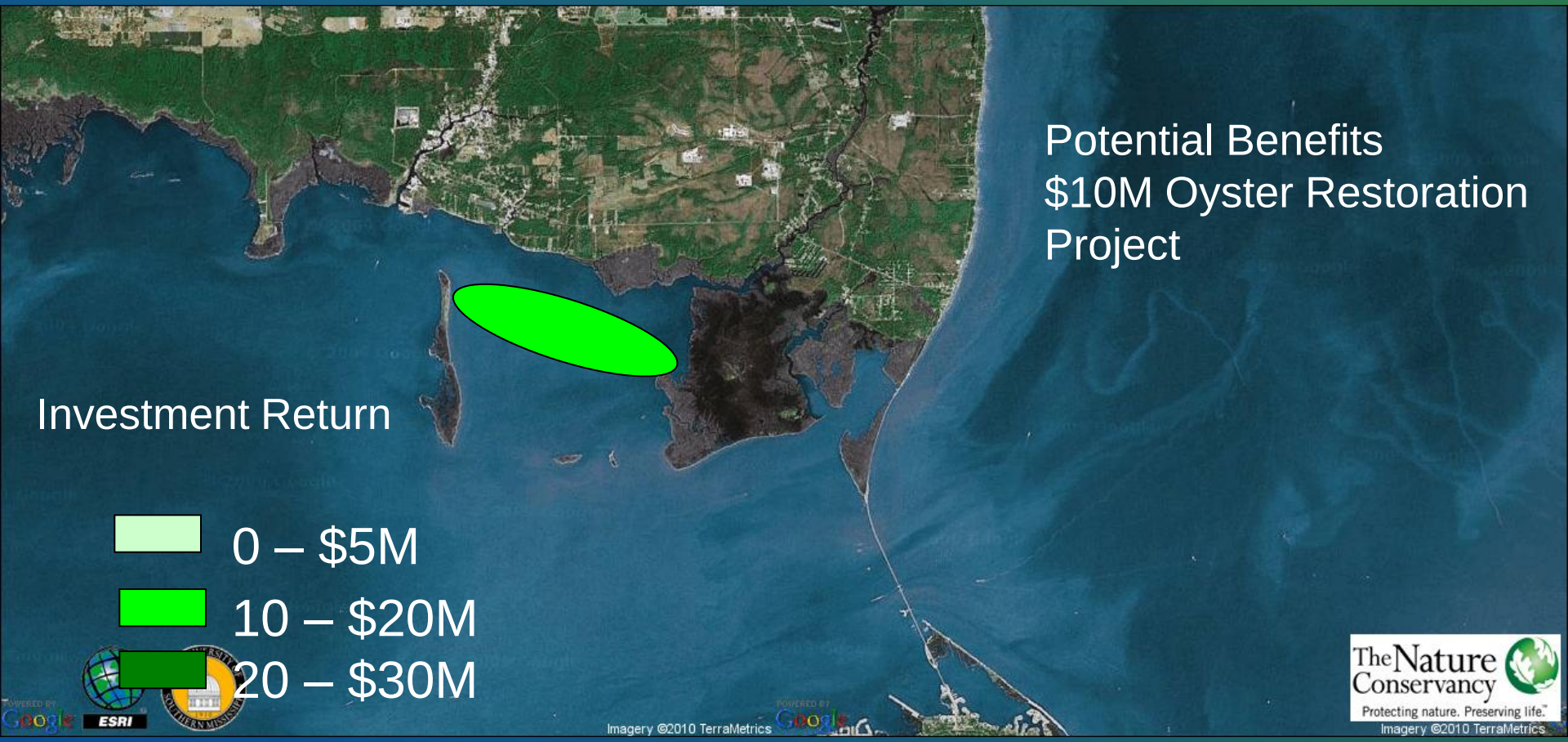
TNC

# Traditional Restoration Benefits




Put & Take = Only Fishery Benefits

# Multiple Restoration Benefits




50% Put & Take + Reef Rebuild =
Shoreline Protection + Rec/Nursery Fishing +
Oyster Fishery Benefits + Water Quality

# Opportunity to link ES + ER

- People are beginning to understand the benefits provided by natural capital
- Increase public and private investment in restoration (i.e., operation and maintenance of natural capital)
- We do this for:

  built capital – dams, highways, and factories;
  human capital – education, health;
  social capital – trust, social groupings;
  so why not for natural capital?

# Opportunity continued…

**Demand currently being driven by regulations requiring mitigation of development impacts.**

CWA: *Final Compensatory Mitigation Rule, 2008*

**Growing concern about ability to verify that restoration projects are providing the ecosystem services desired (i.e., equivalent of healthy ecosystems).**

Bernhardt, 2005

# Time for Action

In 2004, "… recommend[ed] a research agenda centered on ecosystem services and the science of ecological restoration and design." (Ecology for a Crowded Planet)

-- Progress in modeling & measuring ES

-- Markets are driving demand for ER

-- Concerns that equivalent ES are not being created

# Time for Action (continued)

Elements are in place to build a far more efficient, flexible, and effective market-based approach to restoration

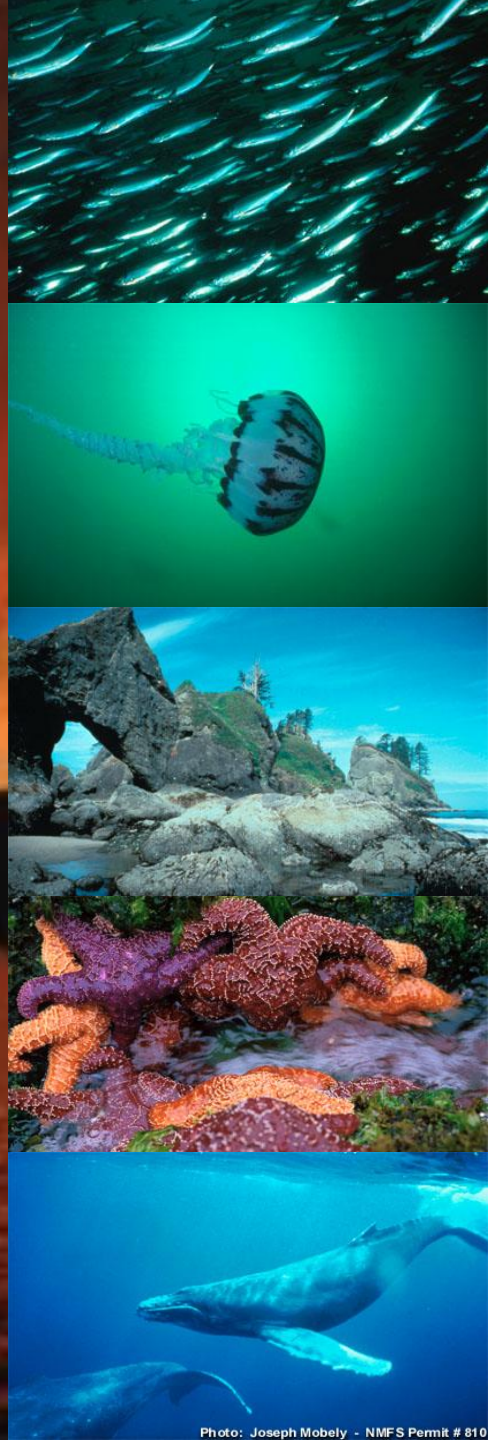
Challenges remain: For example, credible ecosystem service metrics are needed to ensure that ES markets deliver their potential benefits

Ecosystem Restoration and Ecosystem Services scientists and practitioners should work together to realize the promise

# Thank You

Acknowledgements:

Mike Beck, TNC
Don Boesch, UMD
David Festa, EDF
Margaret Palmer, UMD
Mary Ruckelshaus, NatCap
Walt Reid, Packard Foundation
Carl Shapiro, USGS
**Countless others**



# Cultural Differences

| Scientists | Policymakers |
|---|---|
| Operate on facts | Operate on values |
| Seek proof | Operations based on beliefs |
| Written culture | Oral culture |
| Live in a rational world | Live in an emotional world |
| Deal with measurements | Deal with perceptions |
| Make incremental progress | Deal with deadline and crises |
| Deal with thresholds | Legal background--compromise is acceptable |