Facing Tomorrow's Challenges in Natural-Resource Science

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American Association for the Advancement of Science

NASA

Night light from burning fossil fuels: An index of population and human power in the environment

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Deaths:
250,000 seabirds
~3000 sea otters
300 seals
~300 bald eagles
Unknown # of salmon, herring

GULF OF ALASKA

1,500 Miles of Coastline Affected

1989 *Exxon Valdez*

ALASKA
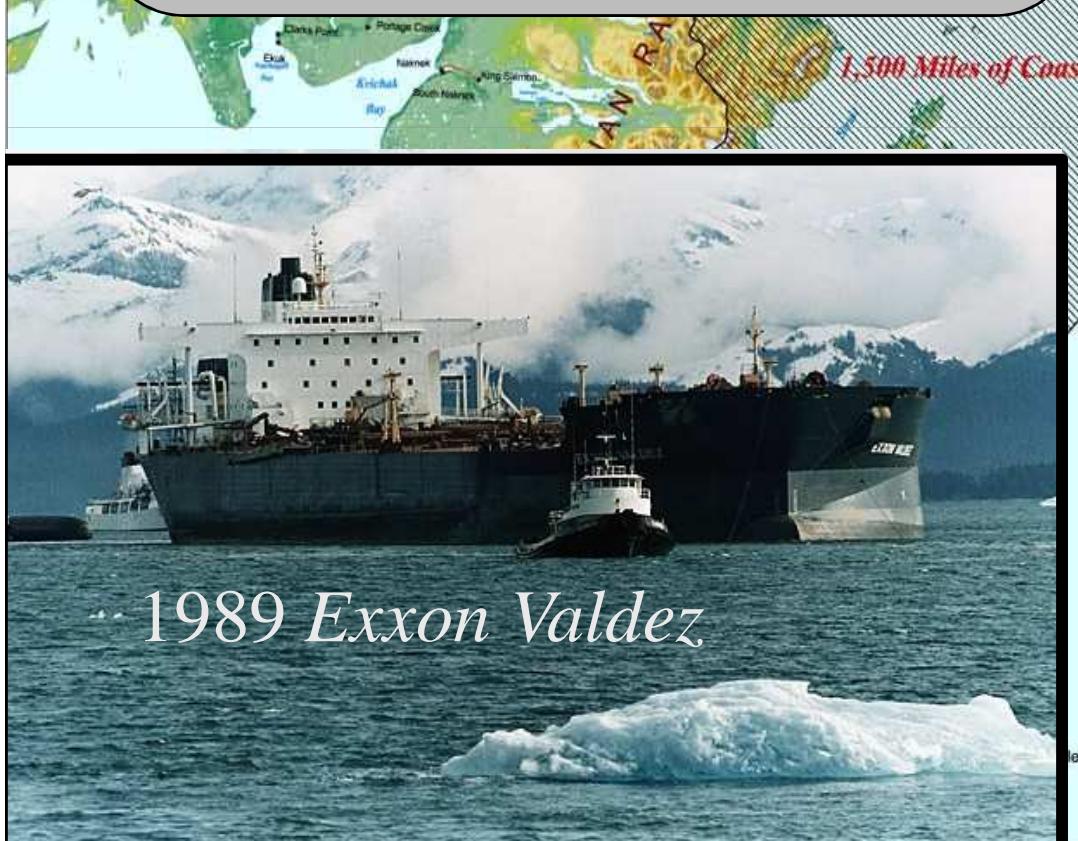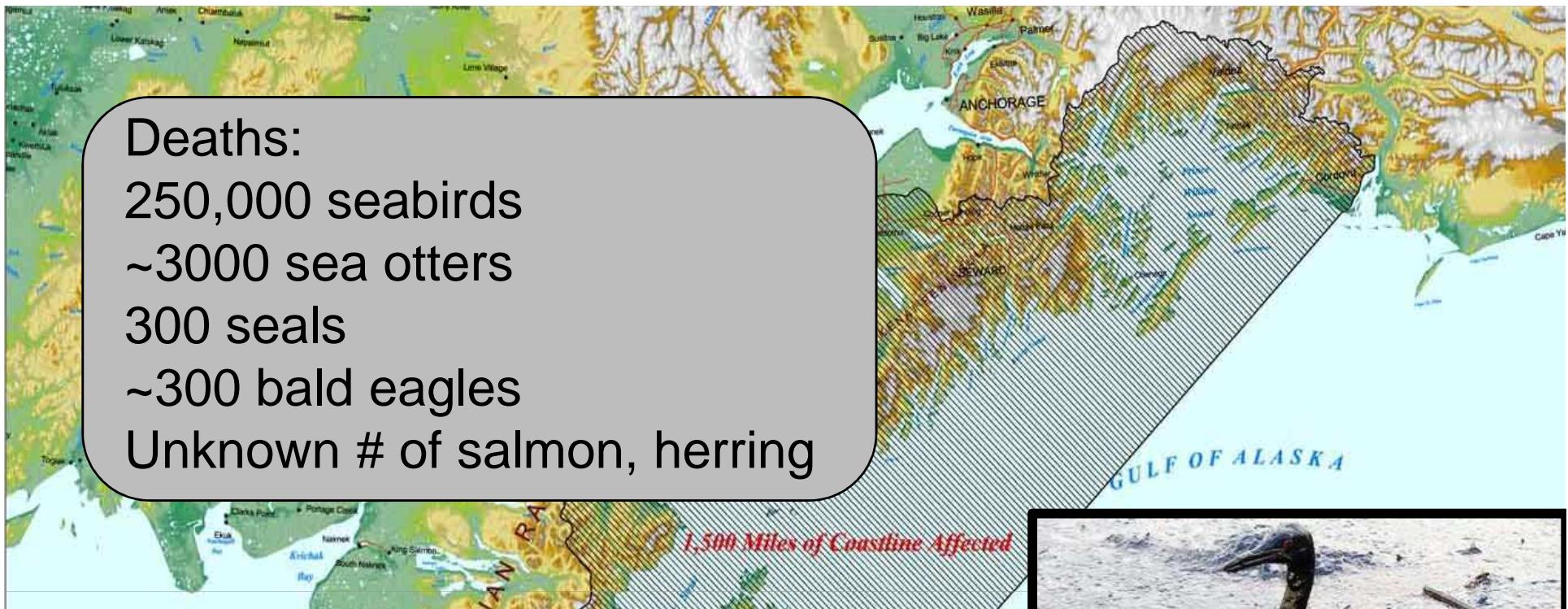
2010 *Deepwater Horizon*

Traditional Natural Resource Management

Based on a single-resource management model
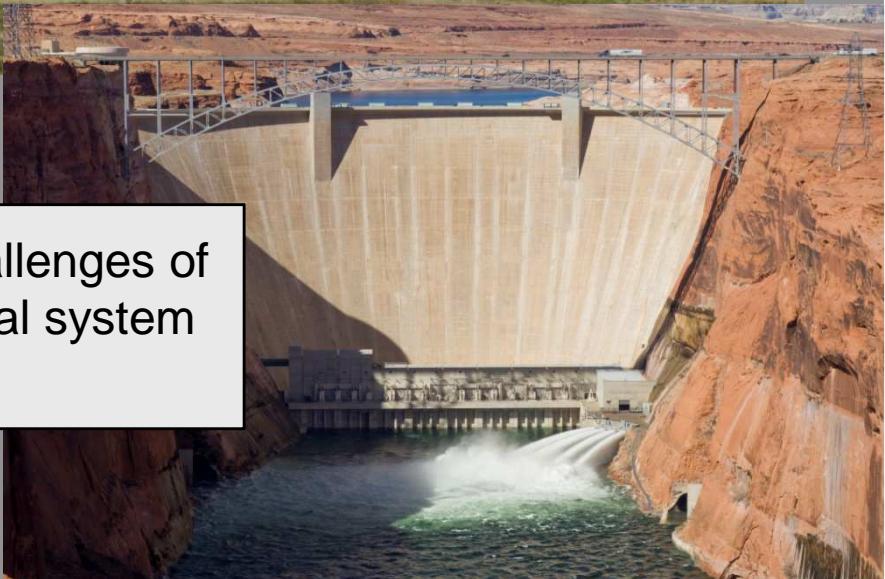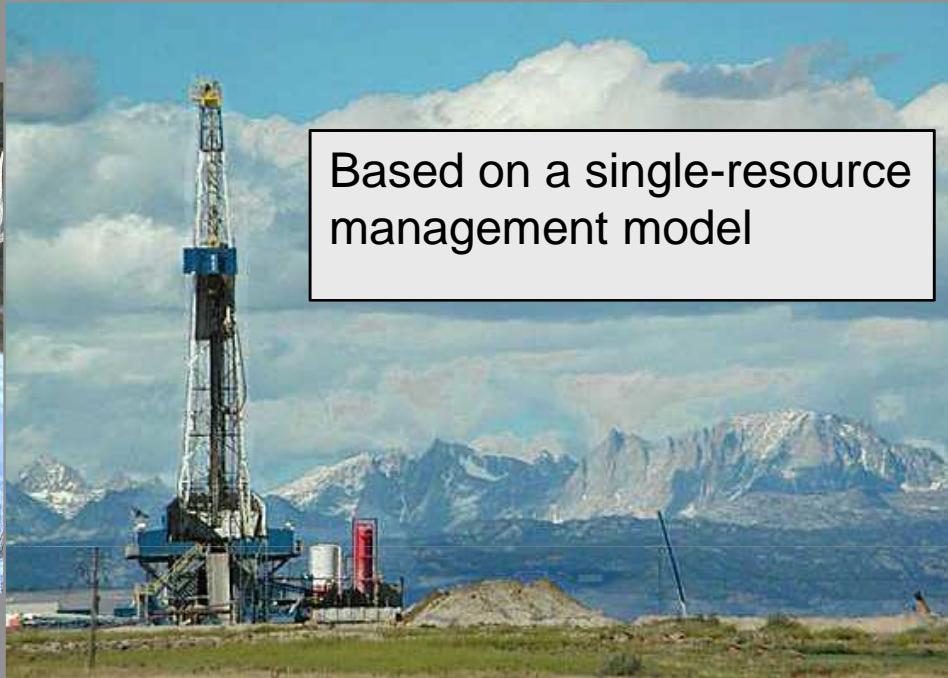
Poorly adapted to confronting the modern challenges of managing the complex coupled human- natural system in times of scarcity

New Approach to Natural Research Management

Machlis and McNutt, Biogeoscience, in prep.

Goal is to provide useable knowledge for natural resource decisions

Provides for crisis management (such as climate change and oil spills)

Assumes that human and natural systems are coupled

Develops the science to understand the system's intrinsic ability to cope with habitat loss or fragmentation, technological failures, increasing resource demand, etc.
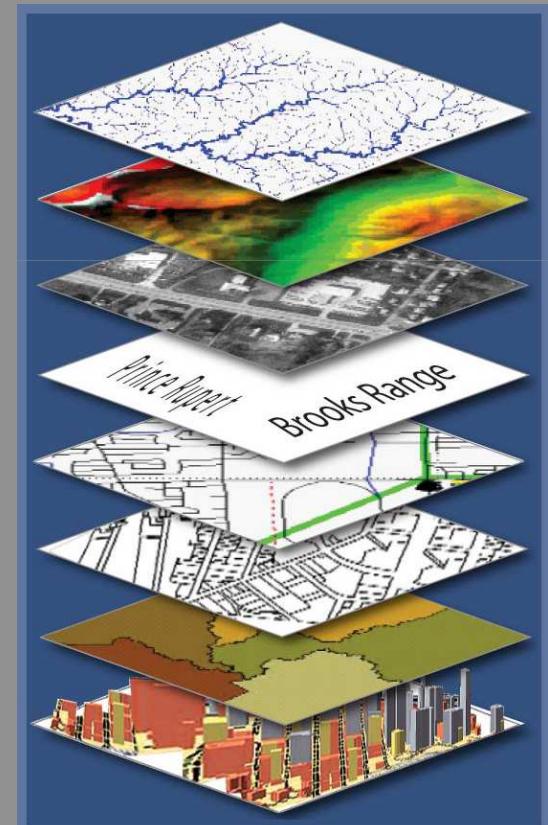
Underlying Concepts

Reserve Capacity –the ability of the system to continue to function absent new input of resources

What is the capacity of the system to aerobically metabolize oil without going anoxic?

Elasticity – the amount by which the reserve capacity can increase or decrease by external factors

How does that change as a tropical storm or other disturbance mixes the water column?

Threshold – a turning point at which a system transforms to a fundamentally different state

At what point does withdrawal of oxygen cause the water column to go anaerobic?

Surge Effect – the result on a system when resources are applied in sudden pulse

What is the impact of an event like Top Kill that flushes multiple well bores at once?

Cascading Consequences – a sequence of events that are cause and effect

What is the impact on the US economy of various choices, short and long term?

Resilience – the ability of a system to take a major hit and come back again to functioning level without costly intervention

How can the GoM become more resilient?

An example: The Gulf of Mexico midwaters with dispersed oil droplets.

Future of Natural Resource Management

Increased demand for energy, food, water, raw materials

Increased vulnerability to natural hazards, climate change

Emerging threats from wildlife diseases on human health

Rising concerns about ecosystem collapse

Require adoption of more effective approaches to deliver relevant science that meets the needs of managers and policy makers.