

An aerial photograph of a coastal region, likely the Hauraki Gulf. The image shows a mix of green land, including forests and some urban areas, and blue water. The coastline is irregular with several bays and peninsulas. The text is overlaid on the top half of the image.

Ecosystem Services and Marine Spatial Management of the Hauraki Gulf

Simon Thrush

Sea Change Tai Timu Tai Pari Stakeholder Working Group Meeting, 25
February 2014, University of Auckland, 321 – level 3 Owen Glenn
Building, 1:45-2:45

DISTURBANCE TO MARINE BENTHIC HABITATS BY TRAWLING AND DREDGING: Implications for Marine Biodiversity

Simon F. Thrush¹ and Paul K. Dayton²

Ecological Applications, 8(3), 1998, pp. 866–879
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DISTURBANCE OF THE MARINE BENTHIC HABITAT BY COMMERCIAL FISHING: IMPACTS AT THE SCALE OF THE FISHERY

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G. A. FUNNELL,¹ R. G. BUDD,¹ C. J. MILBURN,¹ AND M. R. WILKINSON¹

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REVIEWS REVIEWS REVIEWS

Front Ecol Environ 2004; 2(6): 299–306

Muddy waters: elevating sediment input to coastal and estuarine habitats

SF Thrush¹, JE Hewitt¹, VJ Cummings¹, JI Ellis¹, C Hatton², A Lohrer¹, A Norkko^{3,4}

Ecological Applications, 22(4), 2012, pp. 1213–1223
© 2012 by the Ecological Society of America

Interaction networks in coastal soft-sediments highlight the potential for change in ecological resilience

S. F. THRUSH,¹ J. E. HEWITT, AND A. M. LOHRER

What Can Ecology Contribute to Ecosystem-Based Management?

Simon F. Thrush¹ and Paul K. Dayton²

THE MANY USES AND VALUES OF ESTUARINE ECOSYSTEMS

Simon F. Thrush^{1,2}, Michael Townsend¹, Judi E. Hewitt², Kate Davies¹, Andrew M. Lohrer¹, Carolyn Lundquist^{1,3},
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³Leigh Marine Laboratory, University of Auckland, Waiwera, New Zealand

OPEN ACCESS Freely available online

PLOS ONE

Ecosystem Services Transcend Boundaries: Estuaries Provide Resource Subsidies and Influence Functional Diversity in Coastal Benthic Communities

Candida Savage^{1,*}, Simon F. Thrush², Andrew M. Lohrer², Judi E. Hewitt²

Ecological Applications, 18(1), 2008, pp. 12–21
© 2008 by the Ecological Society of America

THE EFFECTS OF HABITAT LOSS, FRAGMENTATION, AND COMMUNITY HOMOGENIZATION ON RESILIENCE IN ESTUARIES

SIMON F. THRUSH,¹ JANE HALLIDAY, JUDI E. HEWITT, AND ANDREW M. LOHRER

Ecological Applications, 23(1), 2013, pp. 226–238
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When small changes matter: the role of cross-scale interactions between habitat and ecological connectivity in recovery

SIMON F. THRUSH,¹ JUDI E. HEWITT, ANDREW M. LOHRER, AND LUCA D. CHEARONI

Visioning the future of the Hauraki Gulf

- Diverse, multi-use, productive, enjoyable, accessible, resilient...
- How do we get there from here?
 - ★ Societal buy in
 - ★ Developing a framework
 - ★ Setting objectives
 - ★ Action
 - ★ Adaptation



We know coastal ecosystems are important

- The 'quality' of the experience is linked to the integrity of the environment



...but how do we define our values and link them back to the functioning and integrity of marine ecosystems?

How do ecosystems work?

It's all about– the physical, chemical, and biological processes or attributes that contribute to the self-maintenance of the ecosystem

- Environmental drivers in space and time
- Disturbance and stress
- Key species
- Species diversity
- Habitat diversity
- Trophic interactions
- Connectivity



Goods and Services

Defining and maintaining the ecological infrastructure...

Over-arching Categories

Ecosystem Goods and Services

Provisioning services

Food provision

Raw materials

Genetic and medicinal resources

Regulating services

Disturbance prevention

Waste treatment, processing + storage

Sediment retention and creation

Biological control

Gas and climate regulation

Nutrient regulation

Cultural services

Cultural and spiritual heritage

Leisure and recreation

Cognitive benefits

Non-use benefits

Speculative benefits



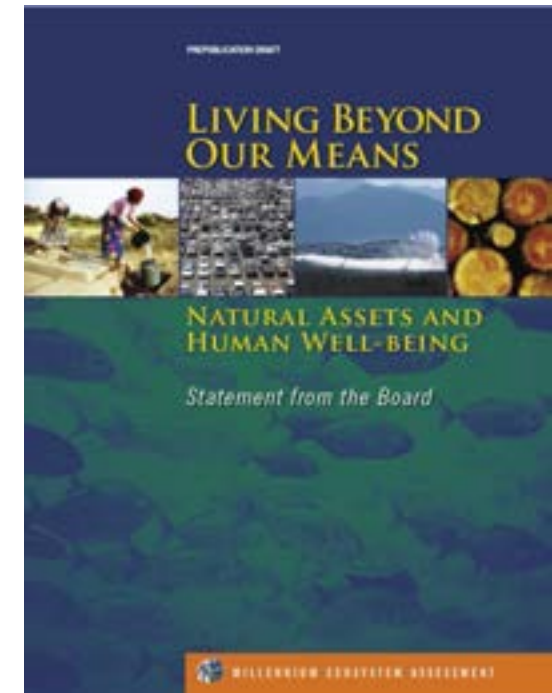
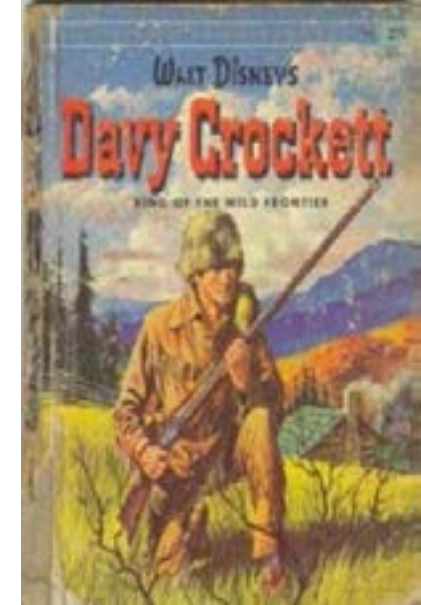


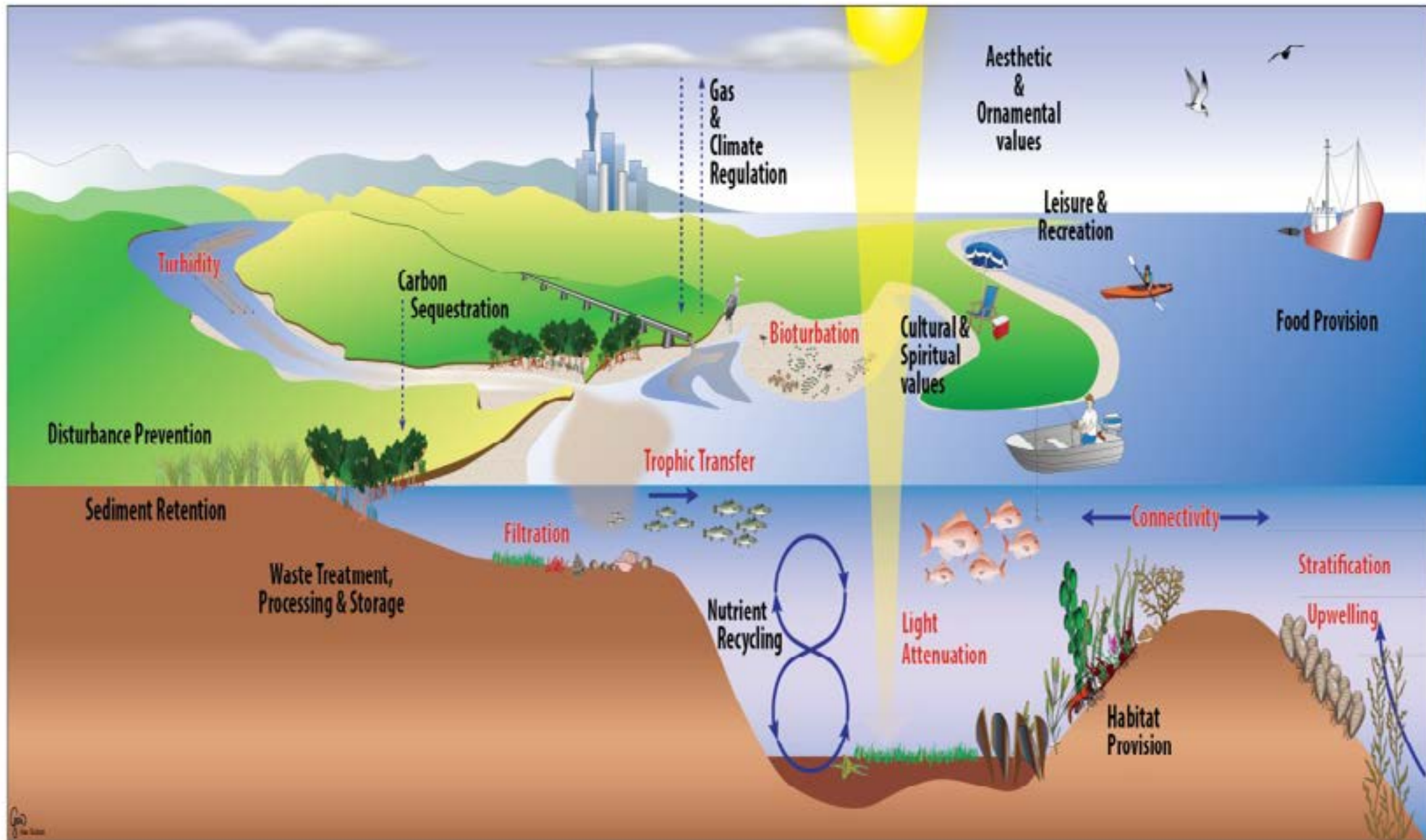
NO MORE WILD FRONTIERS

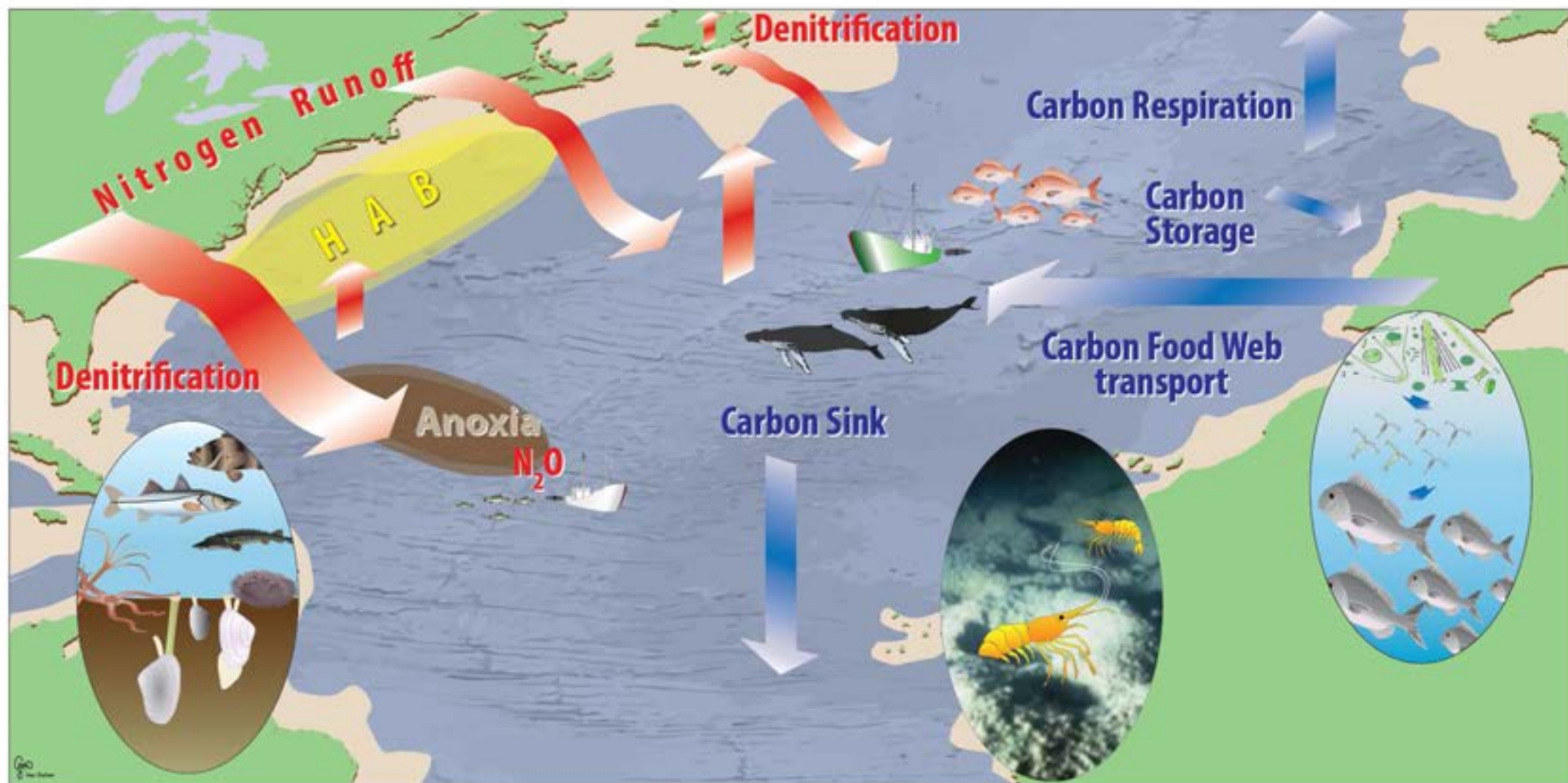
The balance between sustainable use and ecological values is precarious

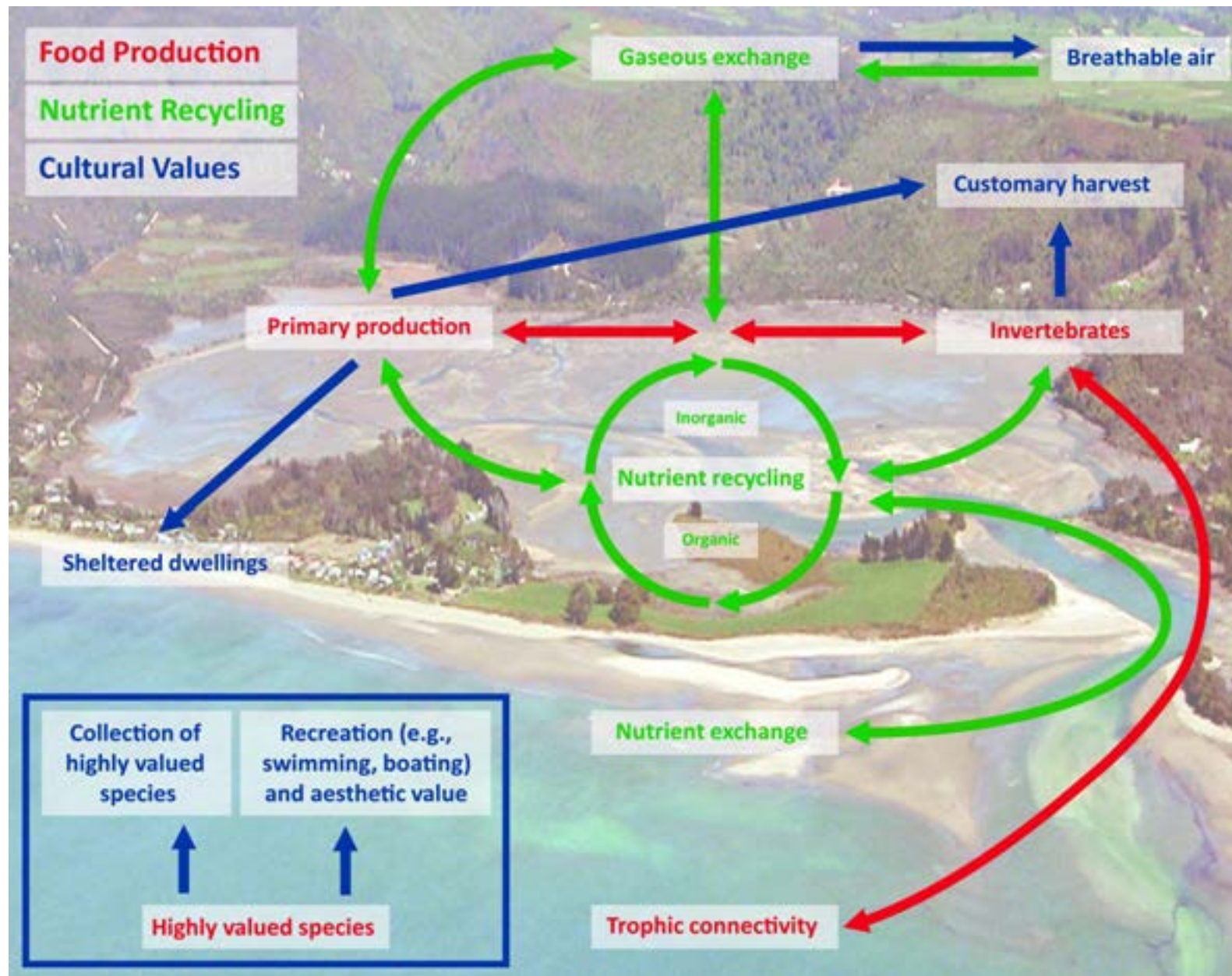
Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.

We must learn to recognize the true value of nature—both in an economic sense and in the richness it provides to our lives in ways much more difficult to enumerate

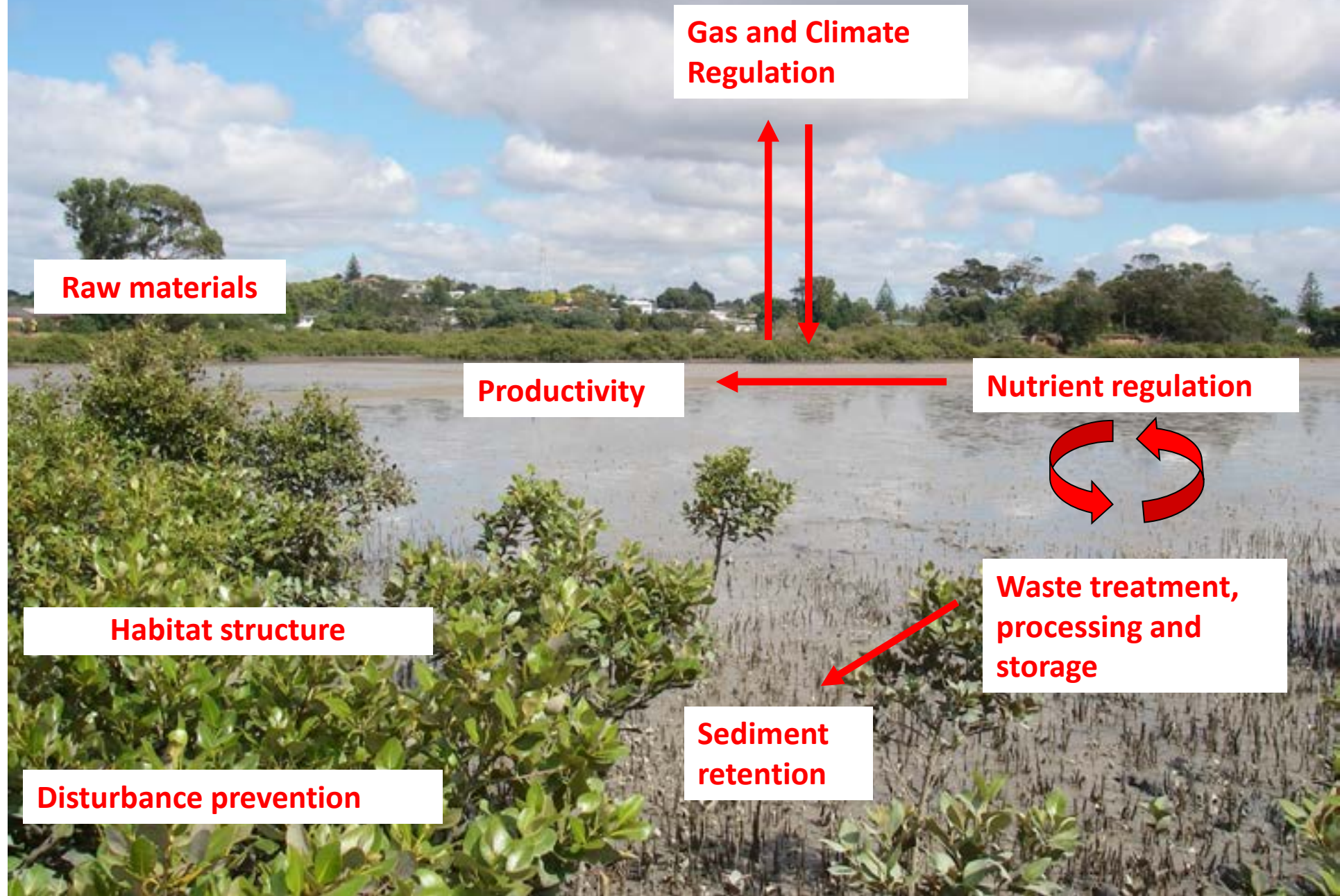




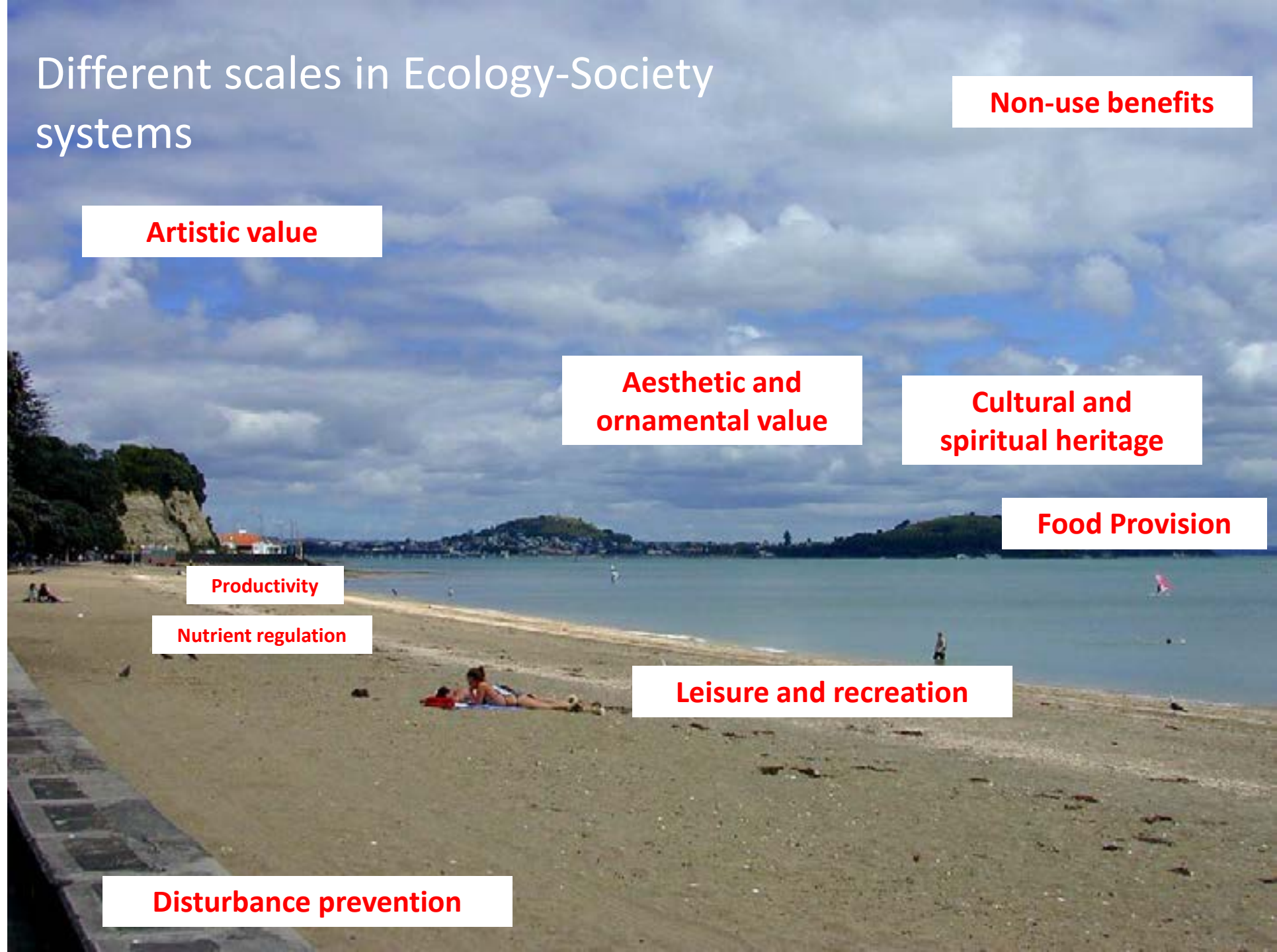




Different scales of space and time



Different scales in Ecology-Society systems



Artistic value

Non-use benefits

**Aesthetic and
ornamental value**

**Cultural and
spiritual heritage**

Food Provision

Productivity

Nutrient regulation

Leisure and recreation

Disturbance prevention



**Ecosystem Services are
underpinned by
bio-physical
processes**

**Density, size and the spatial
arrangement of organisms can
be important**

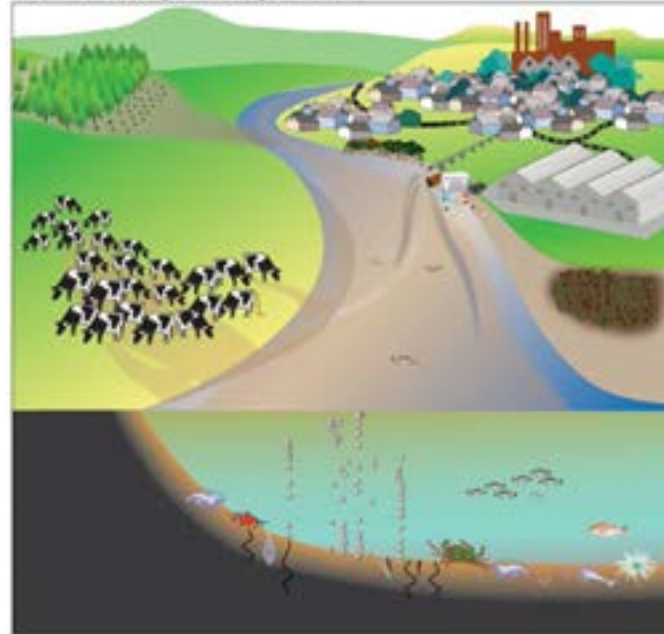




Many types of
estuary and
many habitats



Unhealthy Ecosystem



Healthy Ecosystem



Restricted range of Ecosystem Services



Greater provision of Ecosystem Services

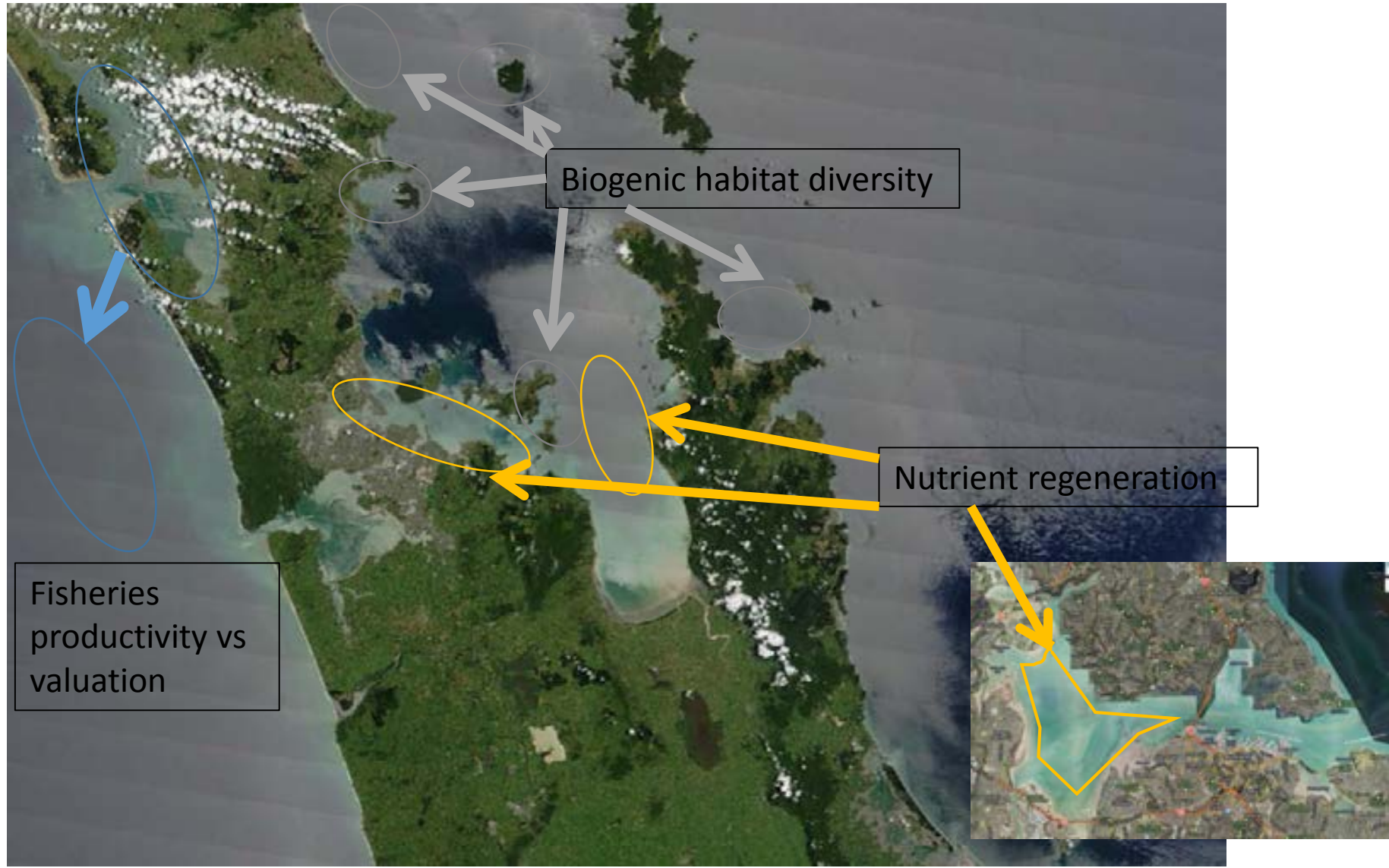


Making decisions using ecosystem service thinking

- A fuller and more open assessment of trade offs
- Better priority setting
- Better targeting for achievable restoration
- Better assessment of loss of resilience
- Better spatial planning



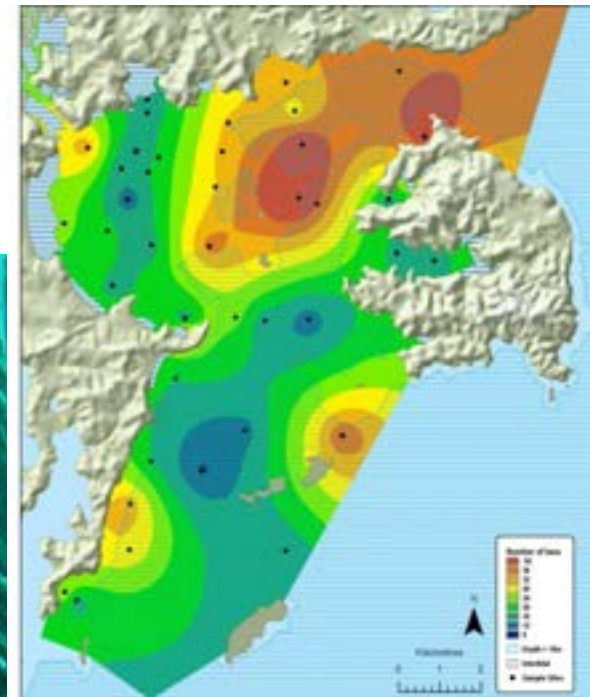
Ecosystem principles help map services at different scales and so how uses can overlap – or not



Core knowledge 1: Mapping and classifying the Hauraki Gulf's ecosystems and defining its status

- We have good information on some of the estuarine and shallow reef habitats, but the broader gulf is poorly described in terms of biogenic (living) habitats.

This lack of knowledge fundamentally constrains our ability to implement spatial plans to fulfil a range of management functions.



The 'Ecosystem Principles Approach'

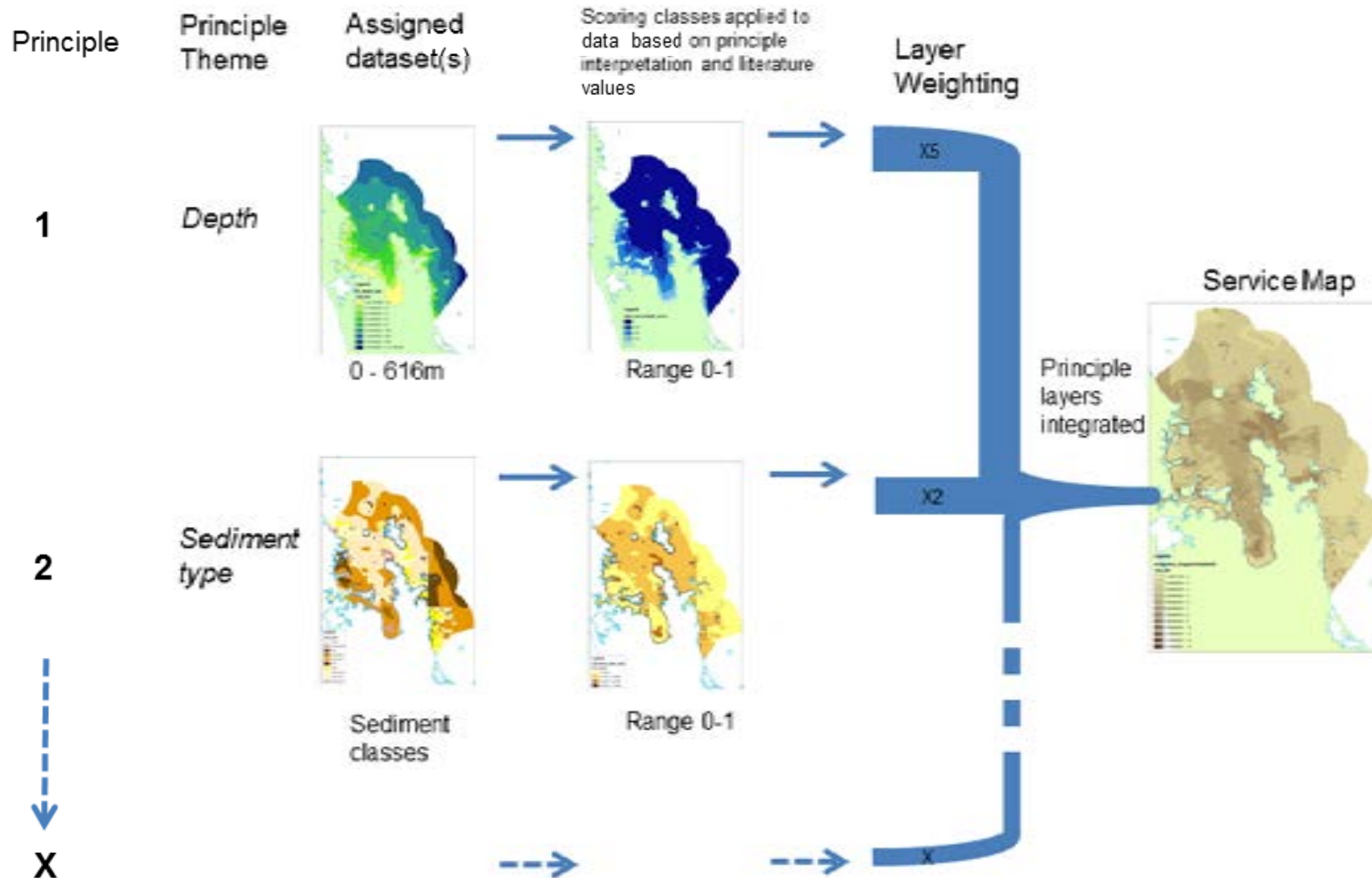
While ecological systems are complex, and predicting specifics can be incredibly difficult, at a certain level generalities can hold true.

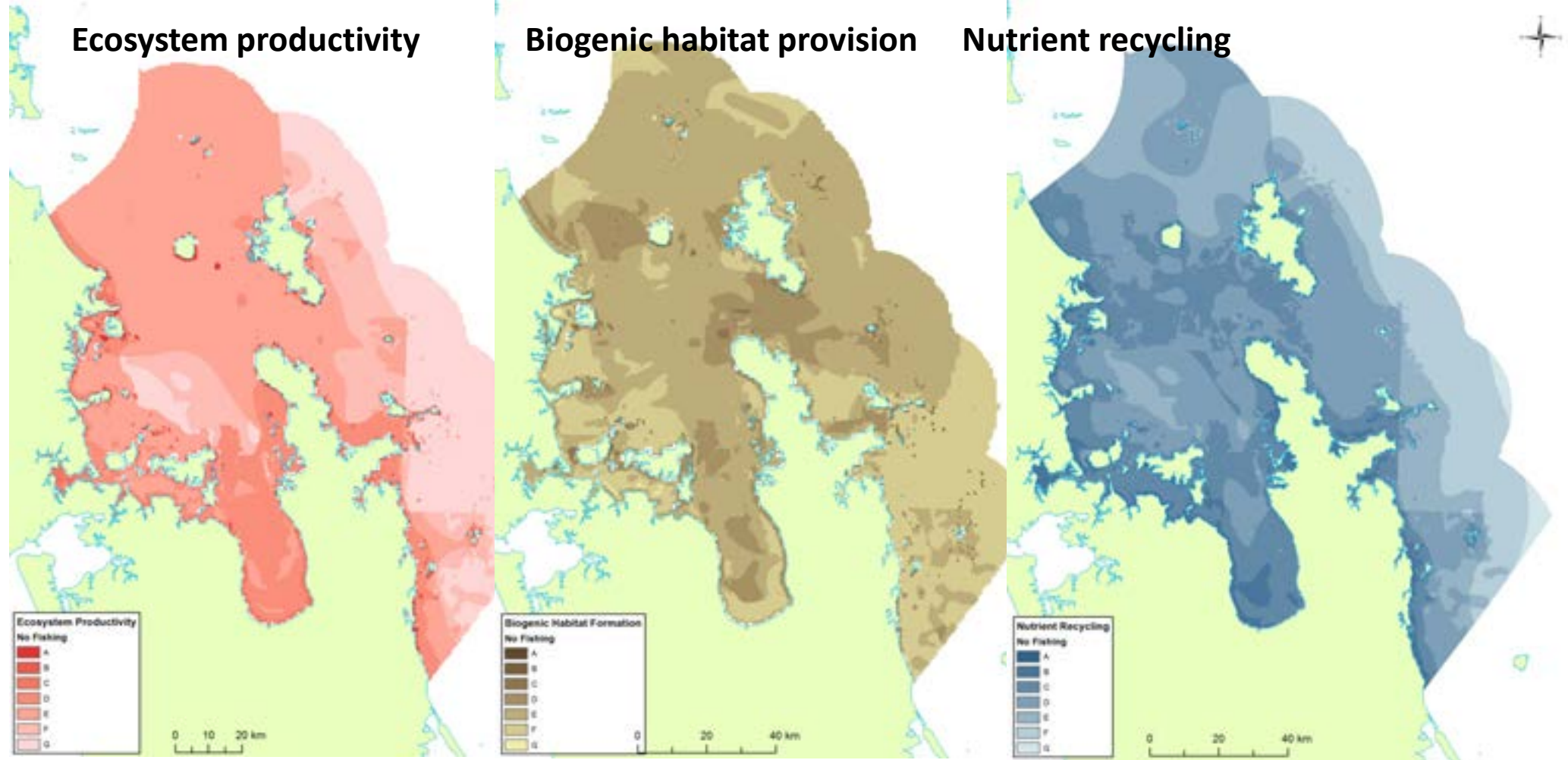
'Ecosystem Principles' are key statements or rules that explicitly define how aspects of an ecological system operate, and aligned to ecosystem services. Collectively the principles summarises the ecological information needed in a clear, scientifically underpinned way that is easily understood and readily applied.

Townsend et al. (2011) Marine Ecology-Progress Series Vol .434

- **P1** Benthic productivity is an important contributor to system productivity and is greater in shallow than deeper waters.
- **P2** Benthic productivity is greater in sandy substrates (i.e., sediment dominated particles in 2 – 0.062mm size range) than muddy substrates (>0.062mm). by

Spatial adaptation of the EPA





Examined 3 ecosystem services using the best available information, multiple principle layers used to produce each map

Held a workshop with 25 of the top scientist for New Zealand coastal science with experience in this region. Evaluated the products and found to be a successful approach, producing maps which meet with system understanding.

The ecosystem service concepts support integrative social, economic and ecological perspectives and thus policies



Environment

- ☐ Biodiversity
- ☐ Ecosystem Processes
- ☐ Ecosystem Functions
- ☐ Biophysical Structure
- ☐ Ecosystem and Landscape Properties

Ecosystem Goods & Services

- Provision
- Regulation
- Culture

Human Wellbeing

- ☐ Health
- ☐ Societal needs & benefits
- ☐ Economic valuation
- ☐ Policy / management
- ☐ Trade-offs, optimisation, cost-benefit analysis

The other eco is complicated too...

J.H. Spangenberg, J. Settele / Ecological Complexity 7 (2010) 327–337

331

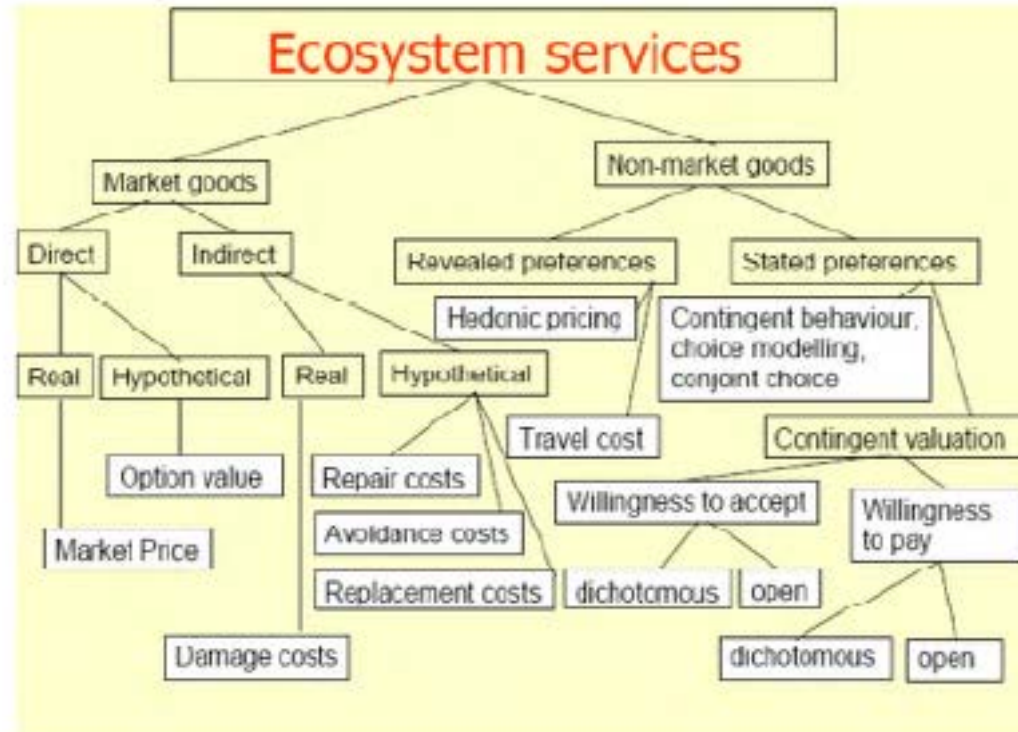


Fig. 2. Clustering economic valuation approaches according to objects and methods.
Source: Compilation by authors.

...but it's not just about \$\$\$, some services should be valued in other ways and ecosystem services are a useful language to identify how different values are underpinned by shared services

Achieving a balance

Short-term, certain,
sectorial use

Long-term, less
certain, multiple-
use



Close out thoughts on ecosystem services

- Do you have to eat it to value it?
- Oceans are NOT inexhaustible?
- Connectivity and the continuity of service delivery across boundaries
- Valuing sustaining and maintaining services is critical – but difficult to untangle from either a social or biophysical perspective

