

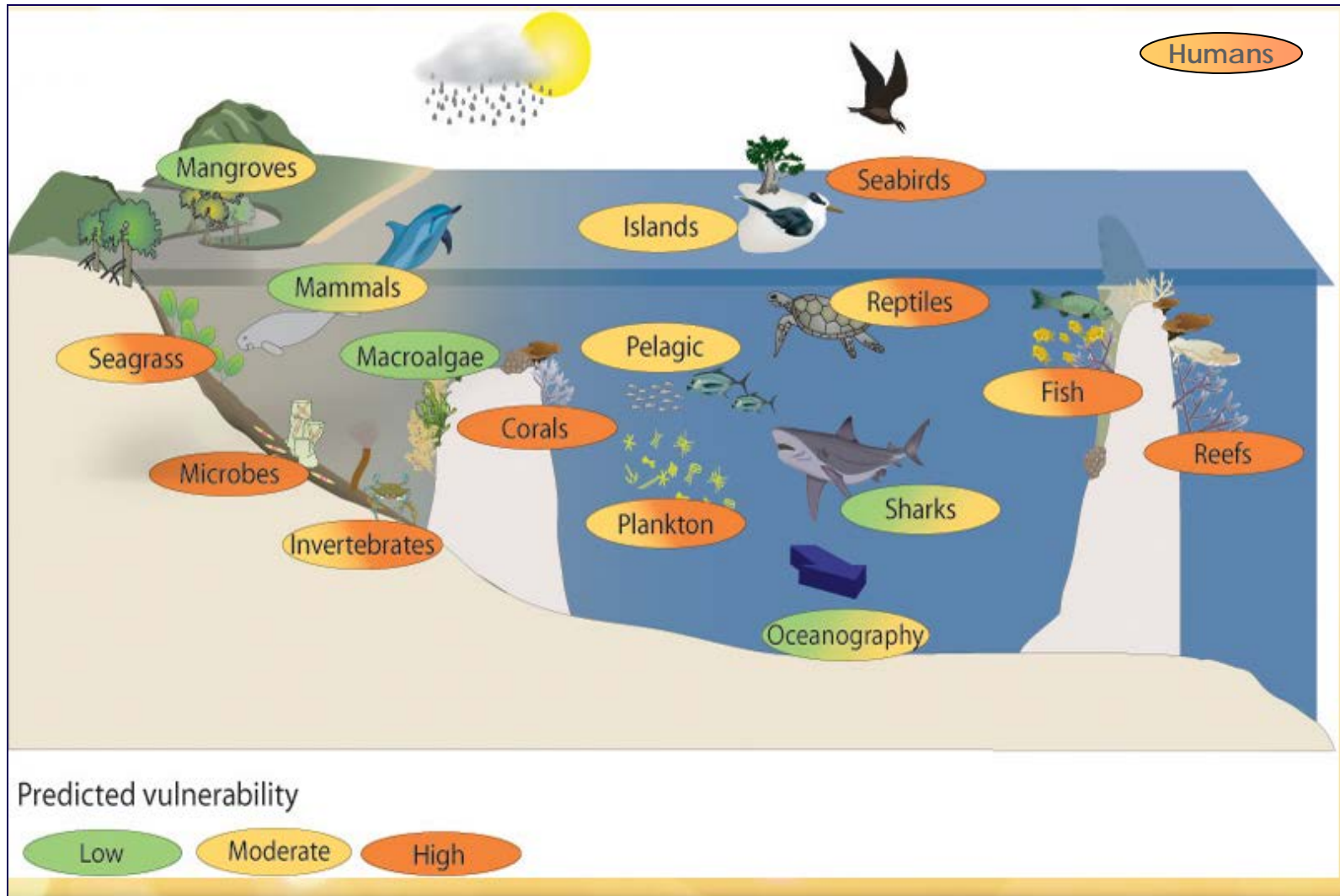


# **Operationalizing Resilience-Based Management in the Maldives: Opportunities with Tourism and Private Sector**

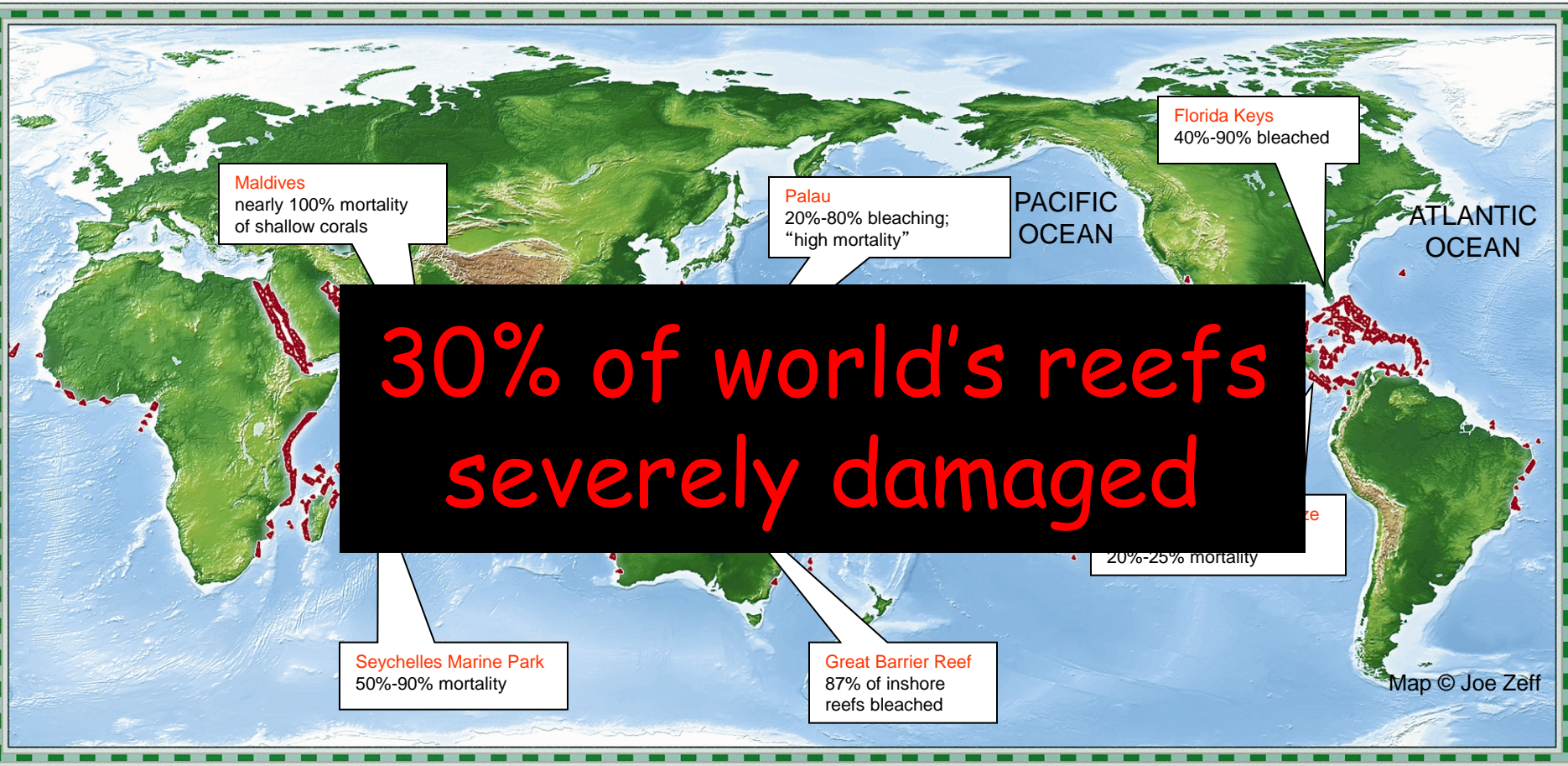
Ameer Abdulla,

Gabriel Grimsditch, Agnese Mancini, Rifae Rasheed, Patrik Svensson,  
Matthias Leisinger, Fabrizio Manco,

# Some more vulnerable than others



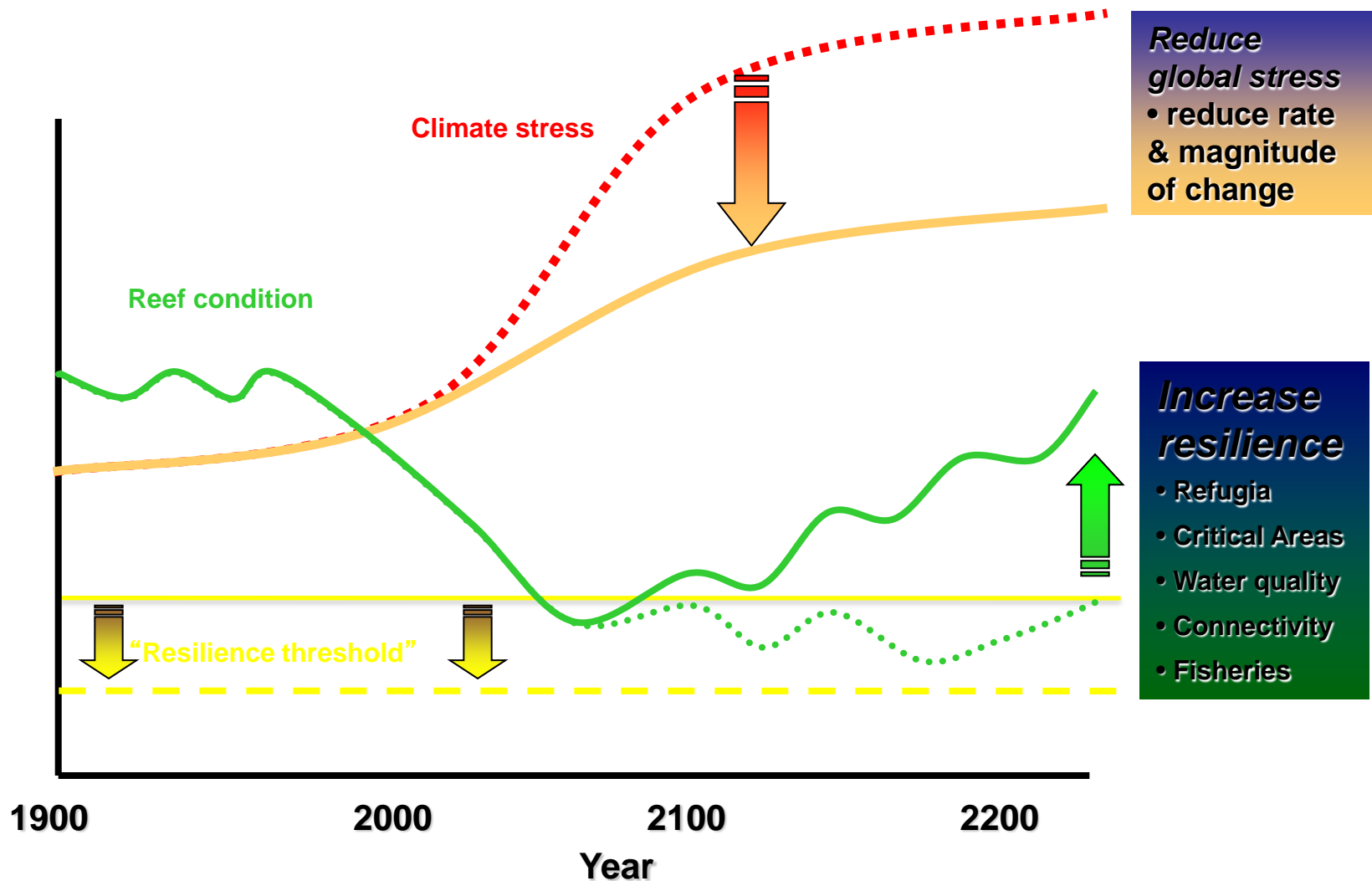
# Global Coral Reef Distribution and 1998, 2003, 2010 Bleaching

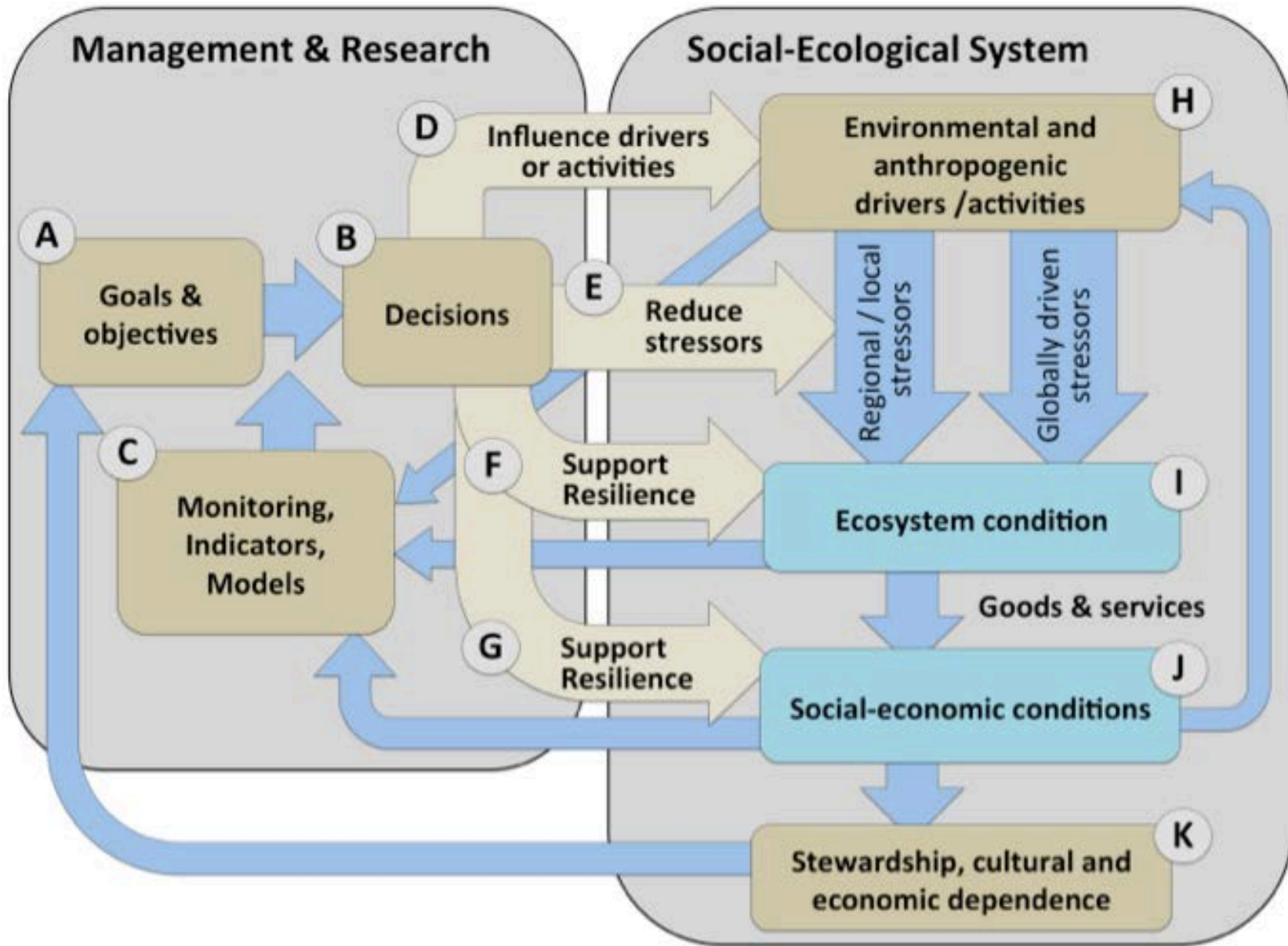


Signs of danger emerged in 1998, repeated in 2003 and 2010, when the surface waters of the tropical seas reached the highest temperatures of modern record, growing unbearably hot for many corals.



# Managing for resilience and adaptation

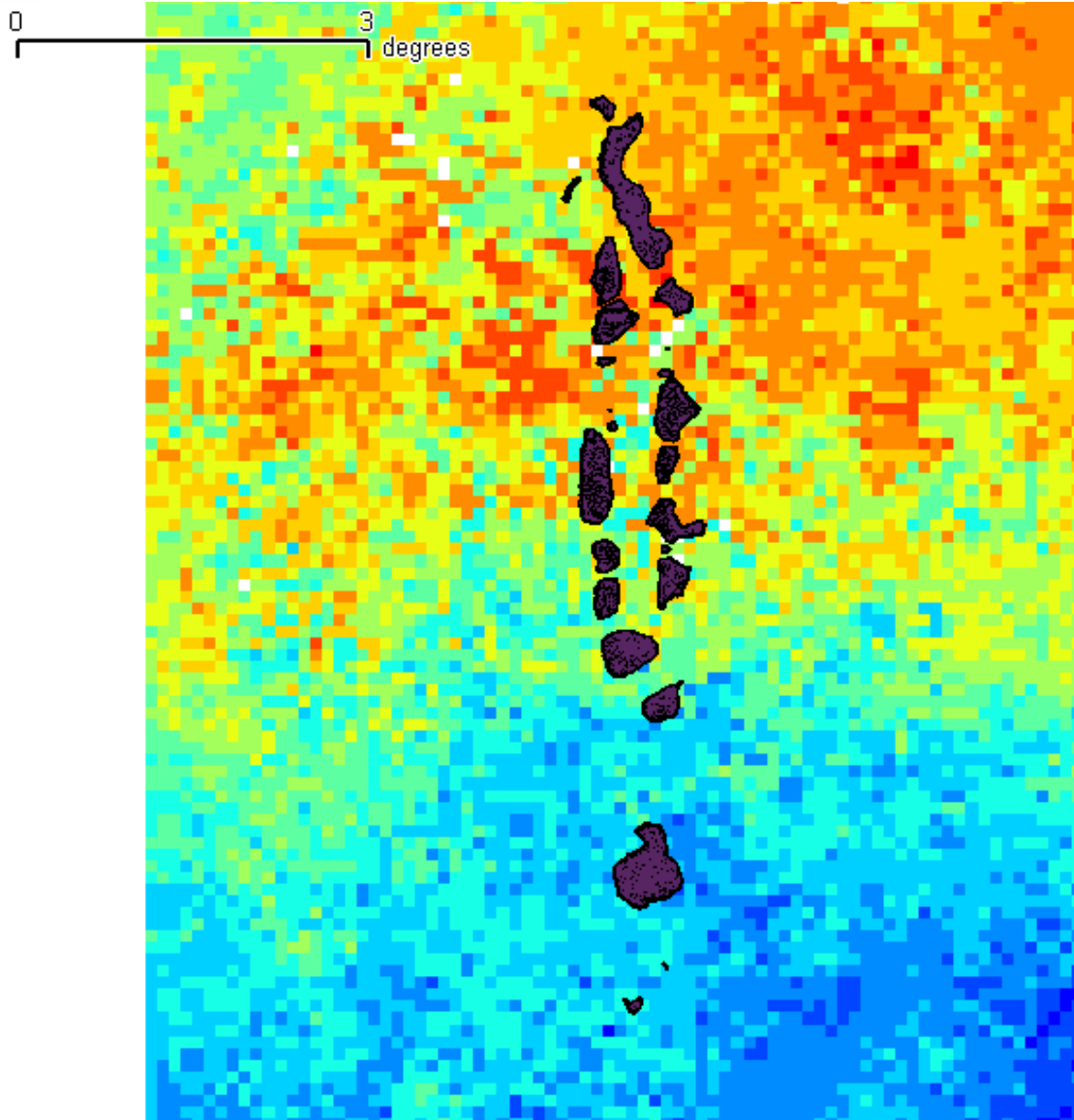




Anthony et al 2014. Operationalising Resilience for Coral Reef Management. *Global Change Biology*



# SST Anomaly Gradient



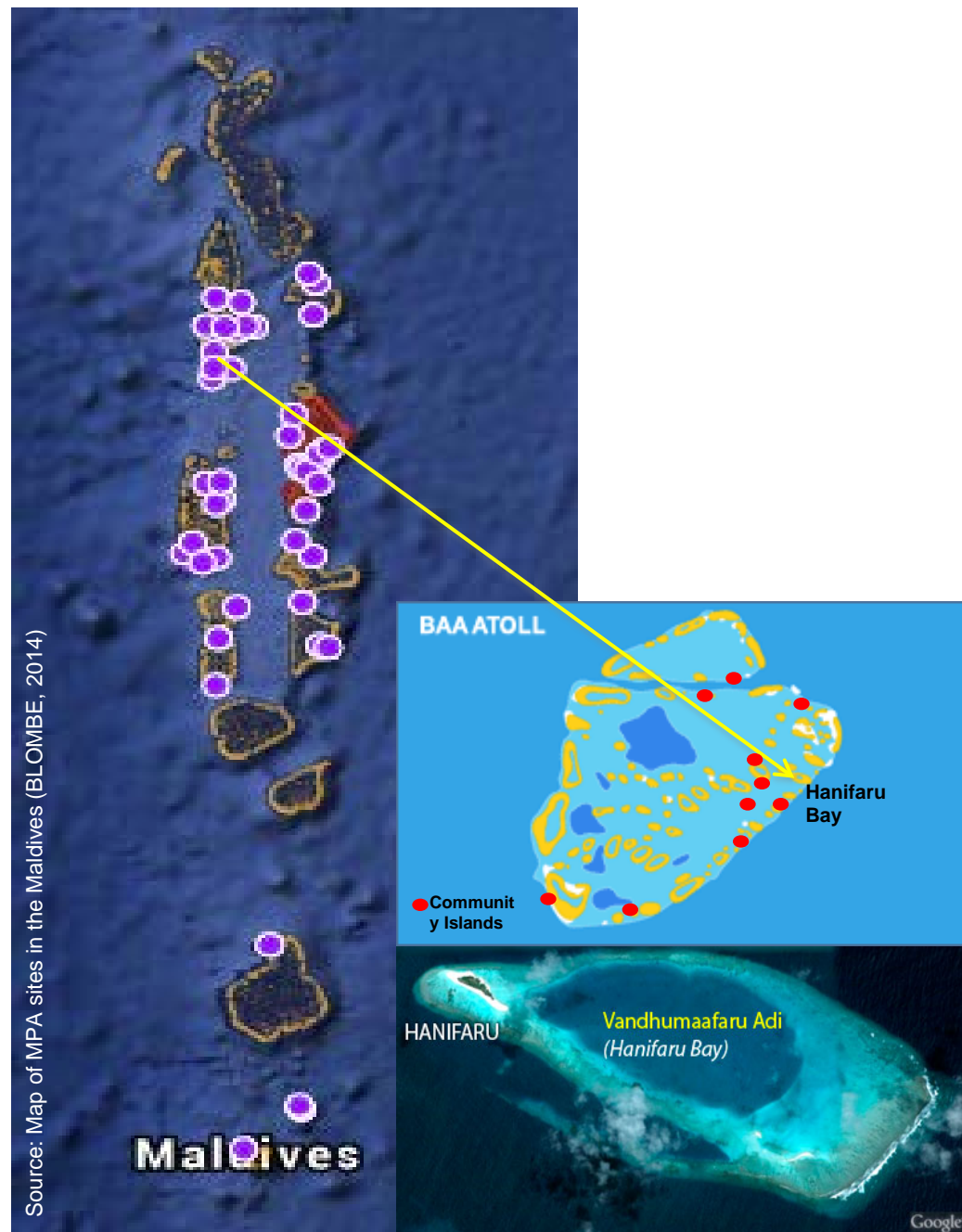


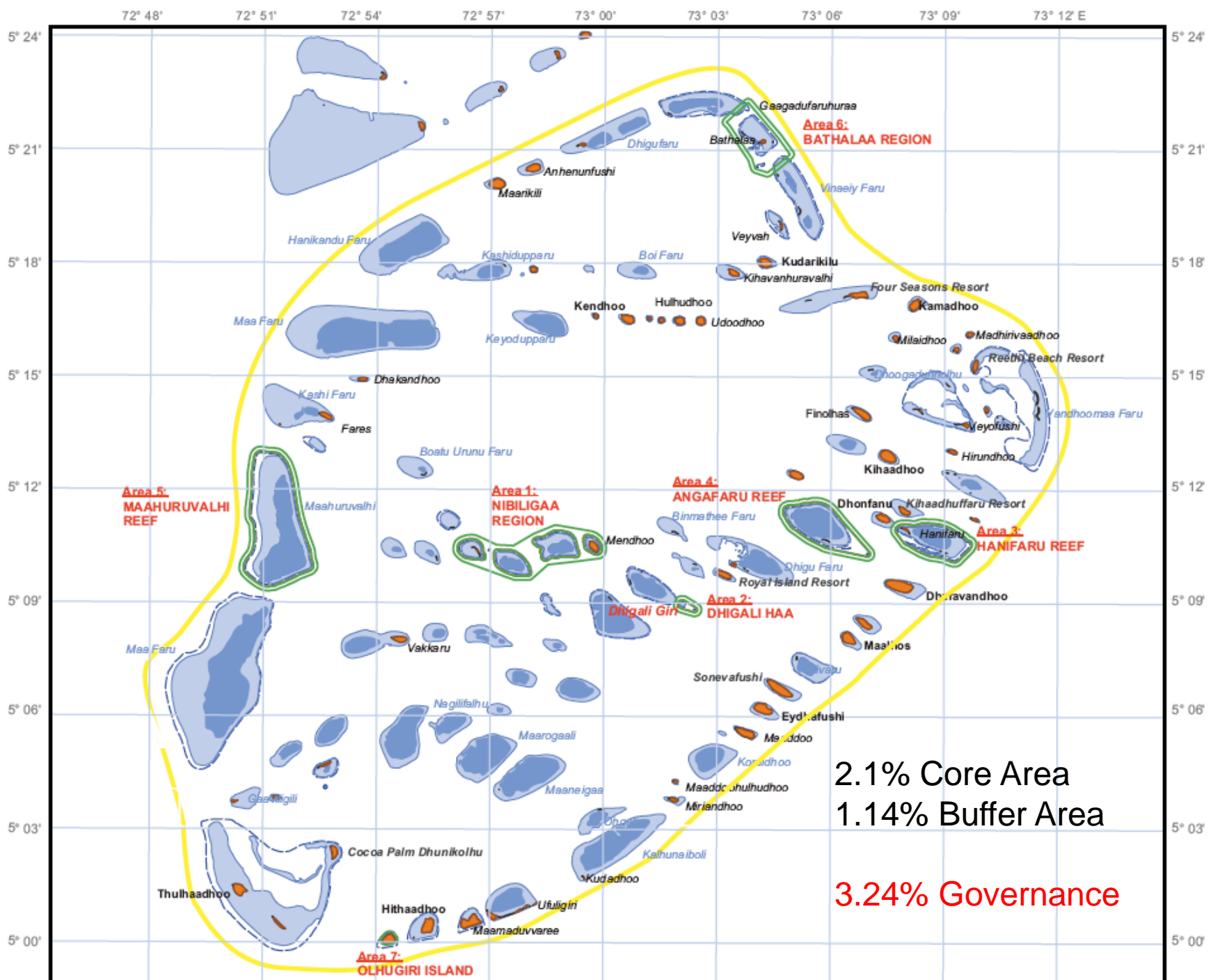
# Marine Governance

1200 islands

- 200 local community islands
- 115 resort islands (now), 200 (by 2020)

▪ 33 MPAs, but only one MPA with a management plan – Baa Atoll Hanifaru Bay





2.1% Core Area  
 1.14% Buffer Area  
 3.24% Governance





**Networks of marine managed areas rather than individual, strictly protected marine areas provide more opportunity for comprehensive management of marine resources.**



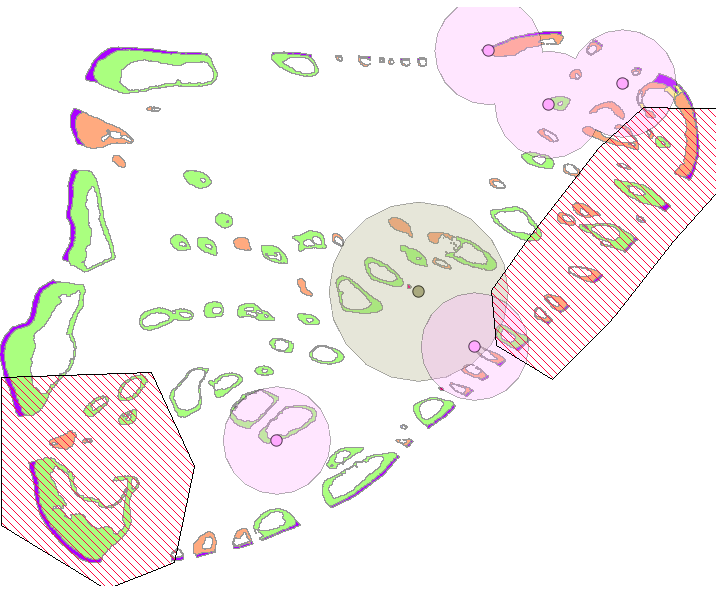
## Atoll Scale Ecosystem Based Management

**Marine Protected Areas**  
(Government)

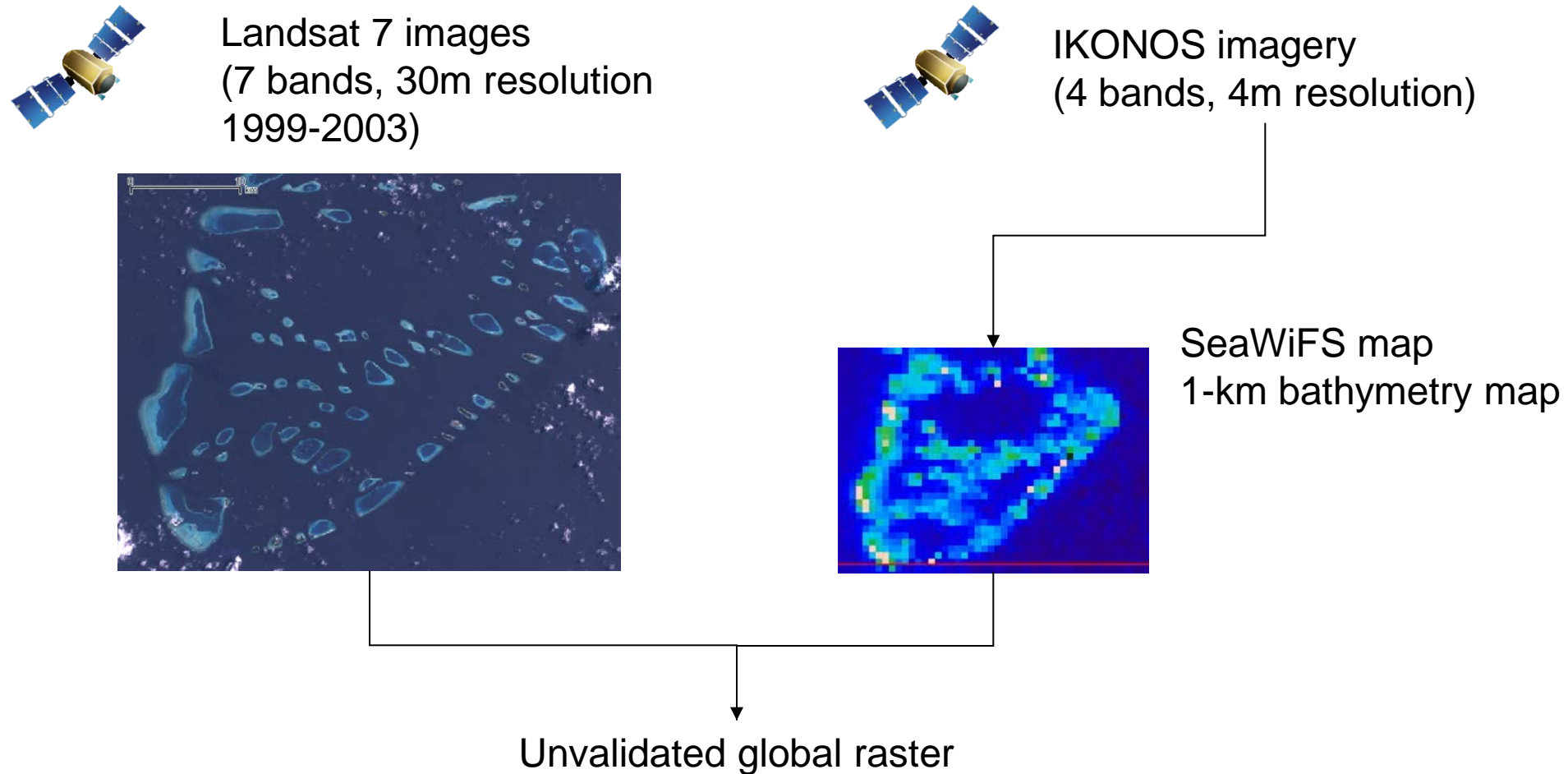
**Marine Managed Areas** (Resorts)

**Local Community Managed Areas**  
(Communities)

Atoll Network of Managed Areas

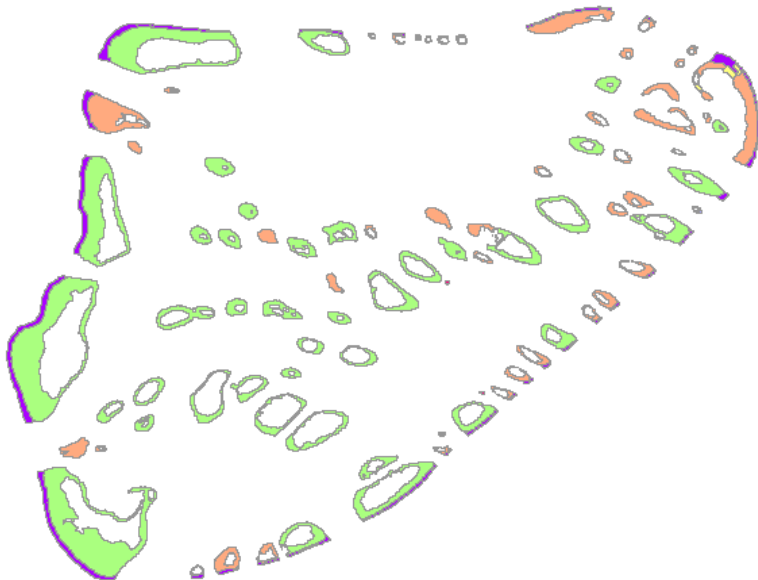


# Preliminary coral reefs classification



# Preliminary coral reefs classification

Unvalidated global raster



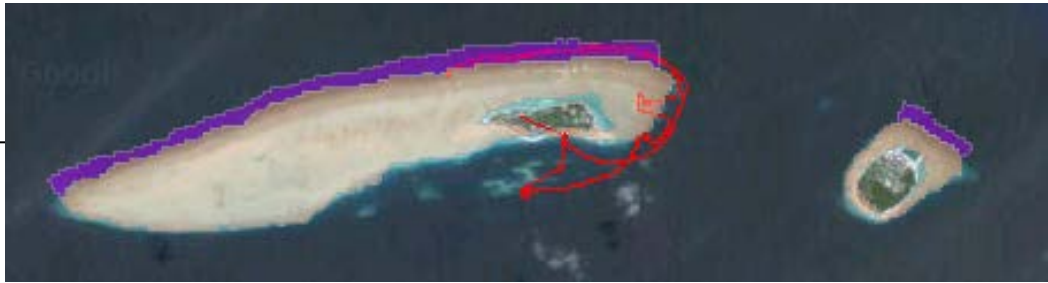
Validated global coral classes  
(30m resolution, 5 levels of coral reef  
geomorphological description)



# Ground truthing and habitat classification

Validated global coral classes  
(30m resolution, 5 levels of coral reef  
geomorphological description)

Ground truthing, site surveys



High resolution remote  
sensing images

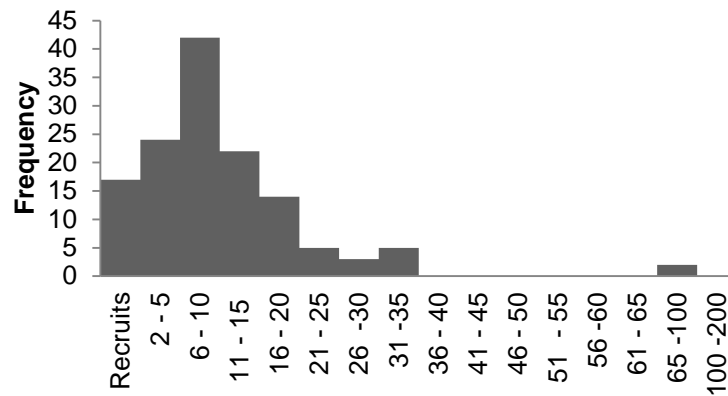
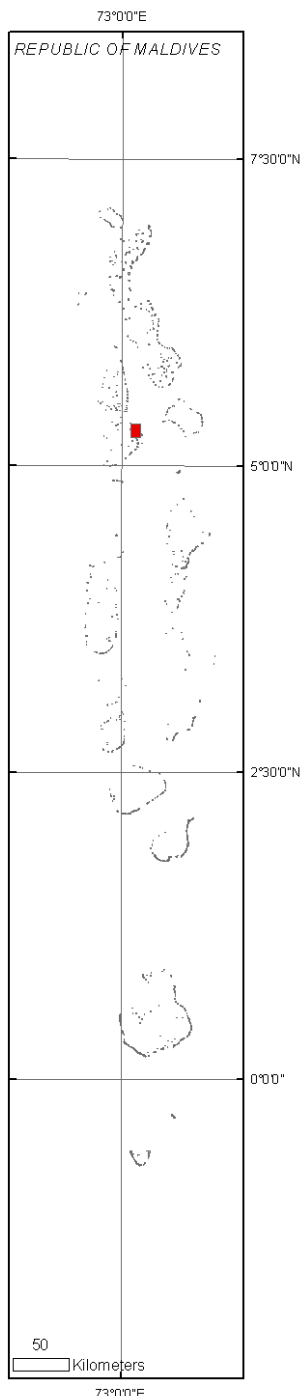
Regional high resolution coral reef  
habitat maps (Island, Atoll)

## Baseline data collection

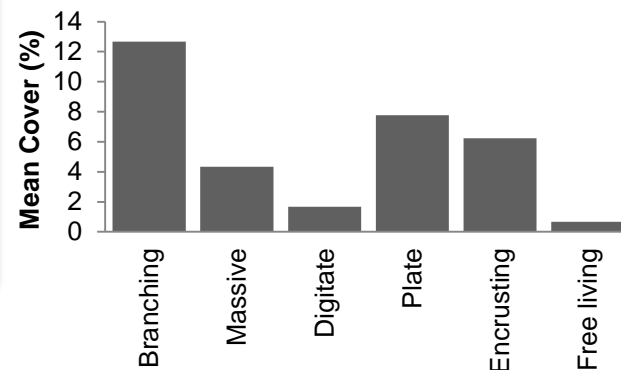
Climate change presentation, followed by resort staff training on marine protocols



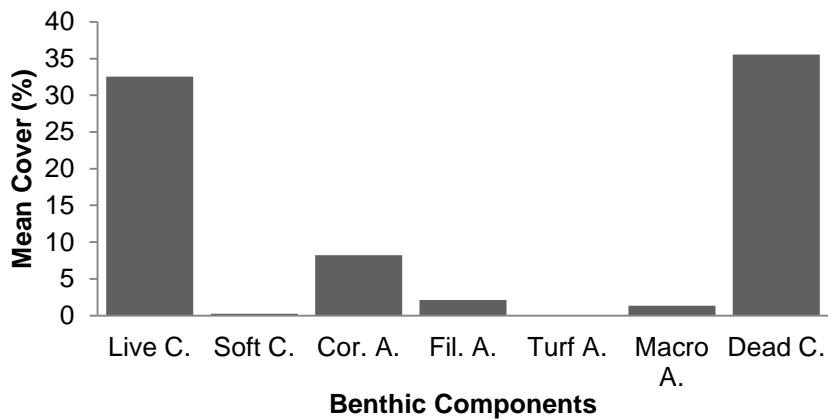
# Ecological data from surveys



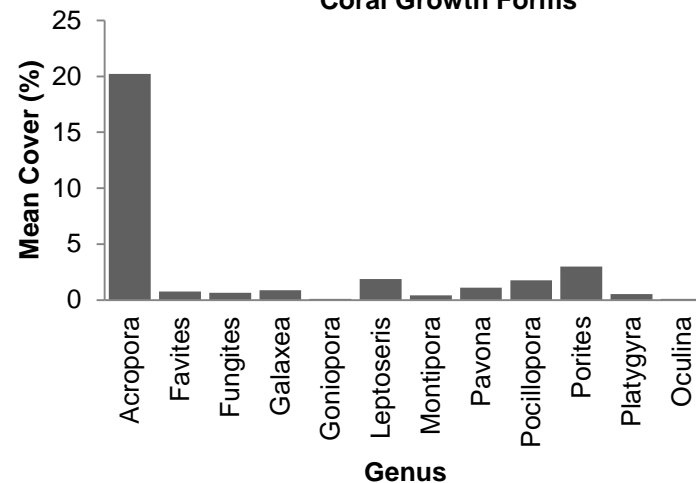
**Coral Colony Size Classes**



**Coral Growth Forms**

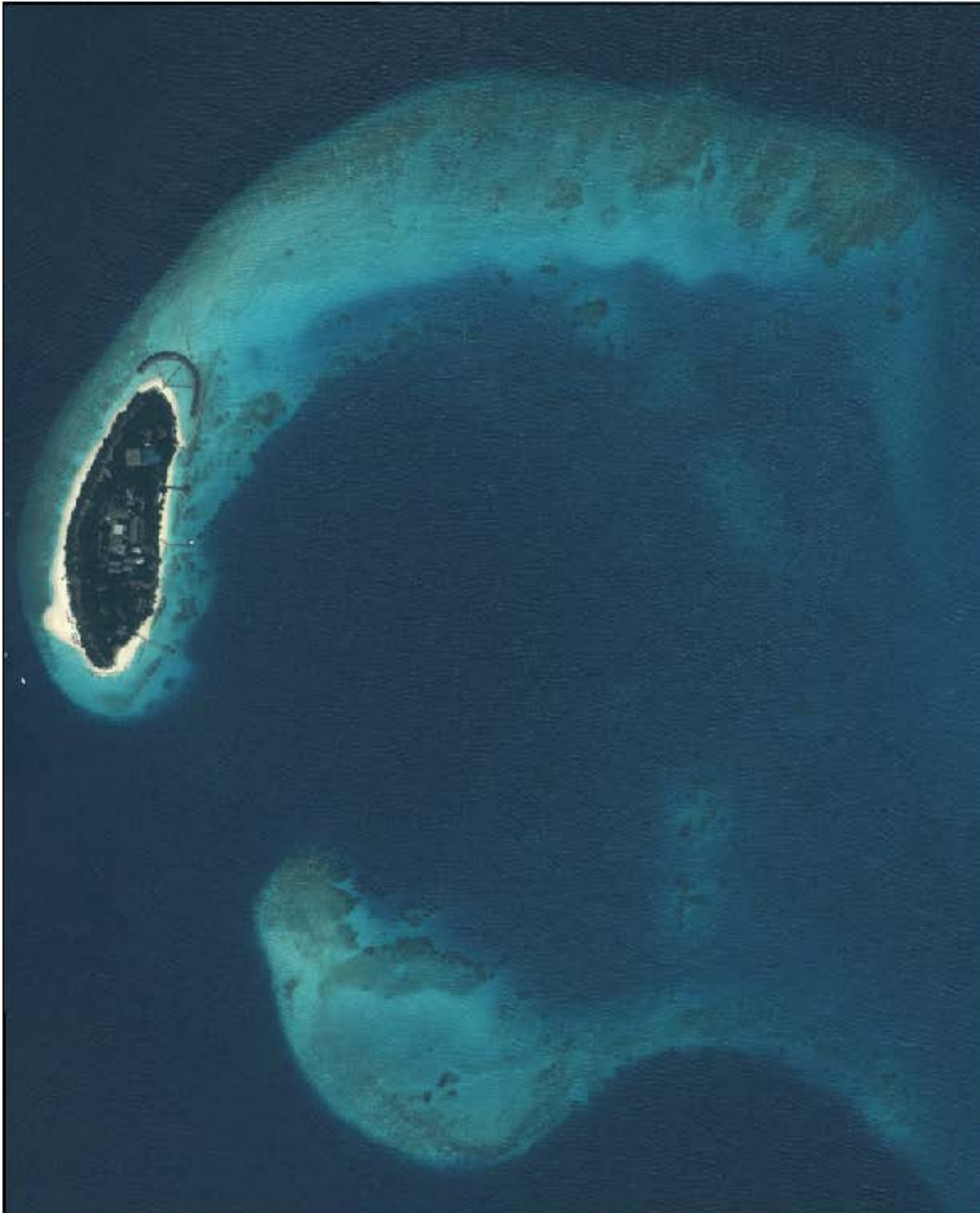


**Benthic Components**



**Genus**

# Satellite Base Map

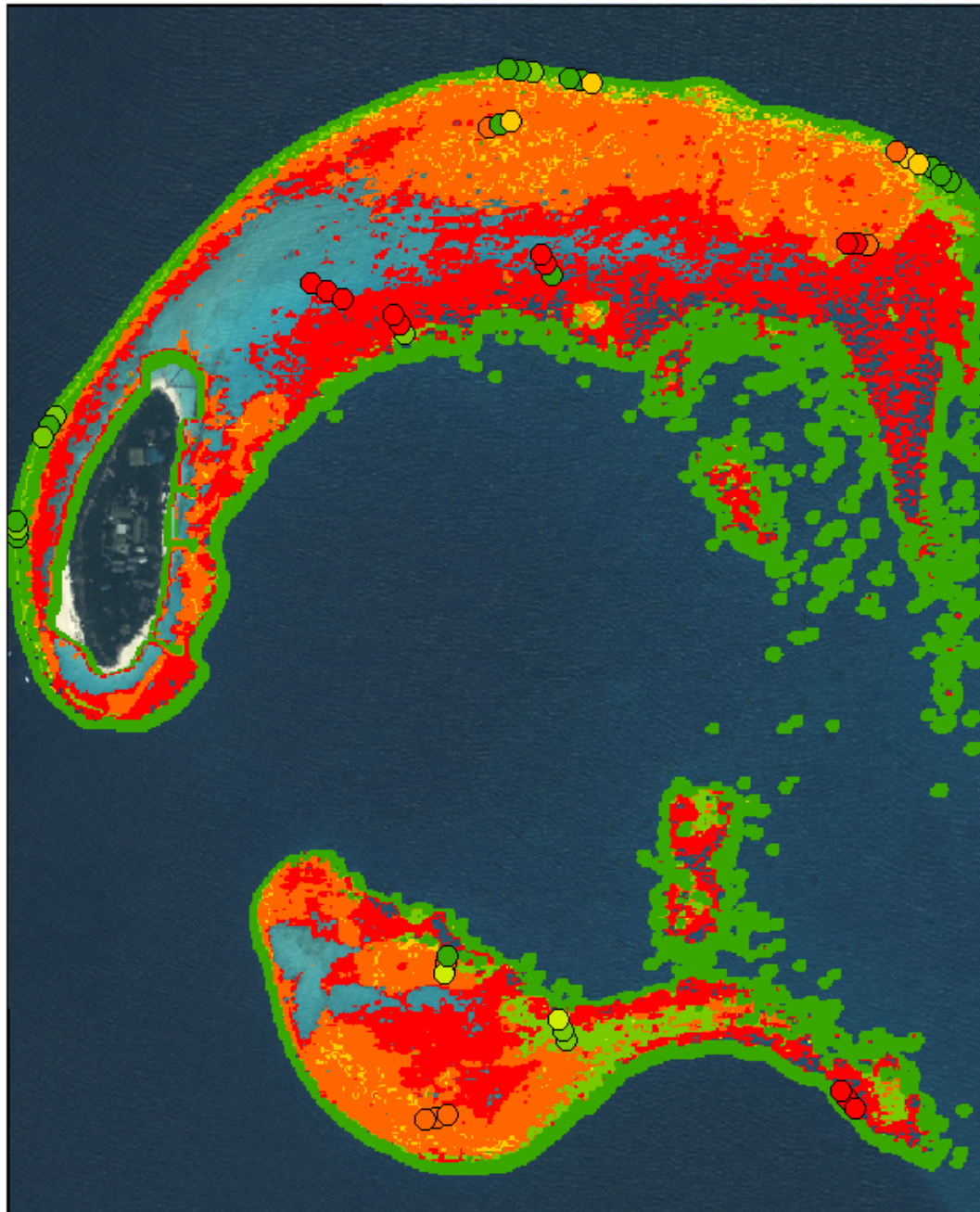


0 125 250 500 750 1,000 Meters



## Live coral, recruitment and coral diversity

- High live coral, recruitment and diversity
- High live coral and diversity, low recruitment
- High live coral, low recruitment and diversity
- Low live coral, high recruitment and diversity
- Low live coral and recruitment, high diversity
- Low live coral, recruitment and diversity



0 125 250 500 750 1,000 Meters

# Disease and Anthropological Impacts

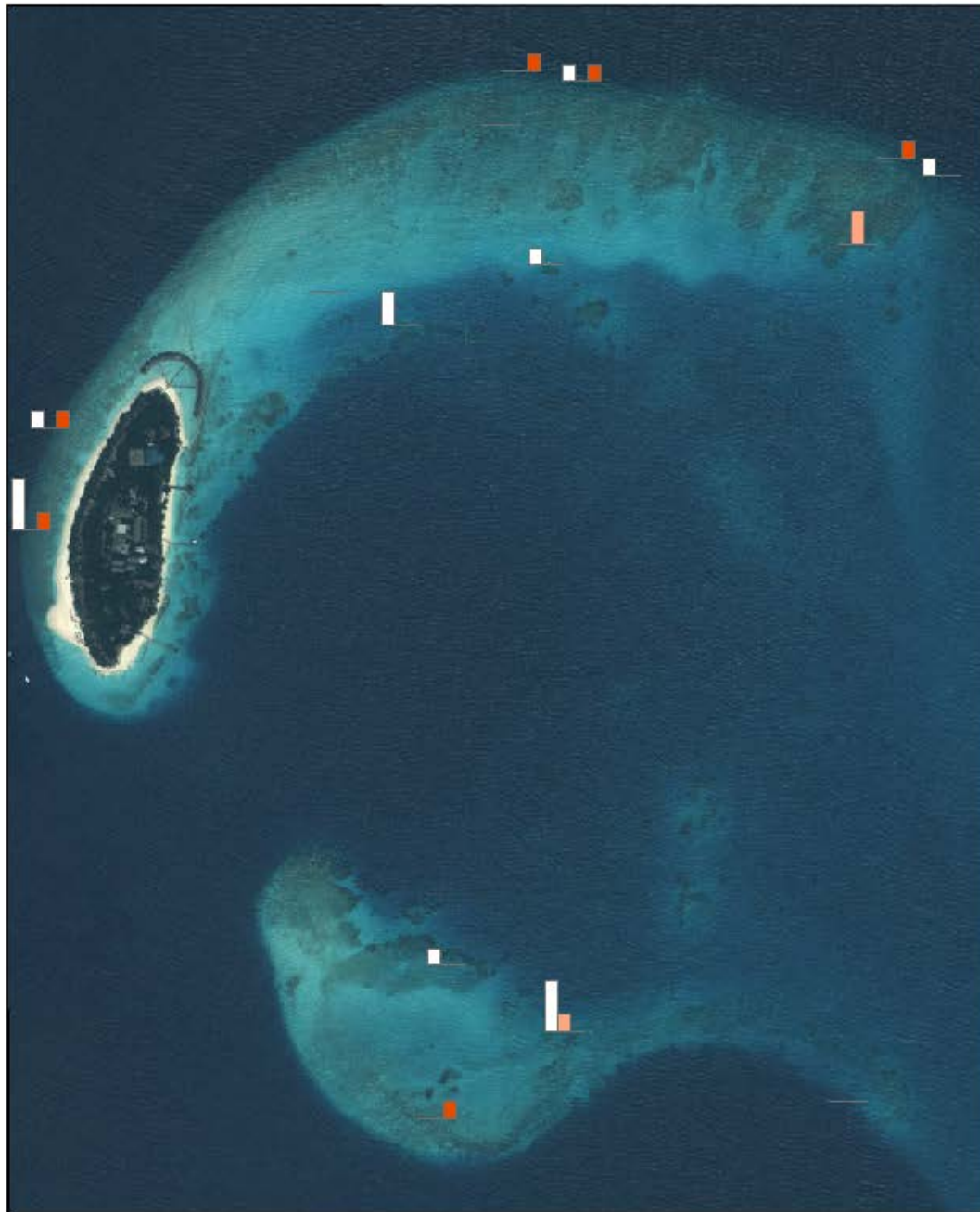
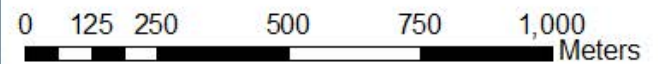
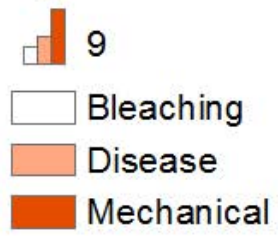
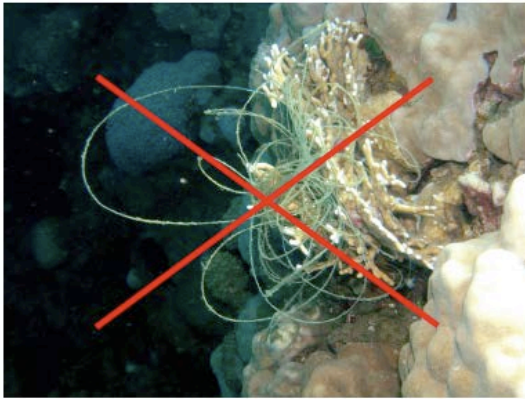


Figure 21 Fishing line is readily entangled on coral



30

The reef flat of your resort discourages your clients.

If your resort offers and reminds them of their misplaced footsteps.

Guests should also be discouraged from activities such as cone shells.

Following these signs:

#### Best Reef Practice

In general:

- No walking on the reef flat without interpretive signs and awareness. Place interpretive signs.
- At all other times, only walk along the water's edge.
- Place signs at the water's edge.
- Reef walking by your clients should only be done as part of a guided interpretive program.

#### Egyptian Legal Requirements

Law No. 102/1983 for Nature Protectorates prohibits killing or disturbing wildlife in protected areas.

Figure 24 The reef flat is vulnerable to damage; discourage guests from walking on it



#### Landfill

##### Background

Solid structures such as earth embankment jetties or rock breakwaters permanently displace large areas of biologically diverse and productive reef flat habitat. Such infrastructure can also have indirect impacts by restricting water movement across the reef flat and modifying sediment depositional patterns. For these reasons, solid structures on the house reef are strictly prohibited.

Figure 22 Rock breakwaters destroy productive reef flat habitat



##### Best Reef Practices

- Do not landfill the reef flat or modify it in any way that could affect water and sediment movement.

##### Egyptian Legal Requirements

Article 73 of Law 4/1994 prohibits the construction of any establishment within 200 m of the shoreline, except with the approval of the Egyptian General Authority.

Landfill

# House Reef Management Plans

- Management zones
- Fishing practices
- Landfill / dredging
- Water / sewage discharge
- Legal Requirements
- Bleaching / Sea level rise
- Global best practice
- Approved / accepted by Maldivian Government / Baa Atoll
- Recruitment of Marine Officer