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on Transport, Trade Logistics and Trade
Facilitation

**Third Session:
Small island developing States:
Transport and trade logistics challenges**

24 – 26 November 2014

Ecosystems Based Adaptation for SIDS

Presentation by

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United Nations Environment Programme

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Ecosystems Based Adaptation for SIDS

Dr Pascal Peduzzi,
UNCTAD Expert Meeting - "Small Island Developing States: Transport and Trade Logistics Challenges"

25 November 2014, Geneva, Switzerland

1 Threats to SIDS (review)

The slide features a central title '1 Threats to SIDS (review)' in large white font. Surrounding the title are five images: a globe showing temperature variations, a beach with several trucks and people, a close-up of coral reefs, an underwater view of a large pipe with divers, and a boat in the ocean with a large splash of water.



Main threats to SIDS


Climate Change (global threats)

- Storm and tropical cyclones (rain, wind, storm surges, wave energy, soil erosion, landslides, floods)
- Droughts & Wild fires
- Heatwaves
- Sea level rise (coastal erosion, salinization of coastal aquifers)
- Increase in sea surface temperature (coral bleaching)
- Ocean Acidification (impacts on coral and fisheries)

Environmental changes (local threats)

- Pollution (sewage, waste, transport, accidents)
- Deforestation
- Infrastructures (e.g. for tourism)
- Overfishing
- Sand mining
- Decline of ecosystems (biodiversity)

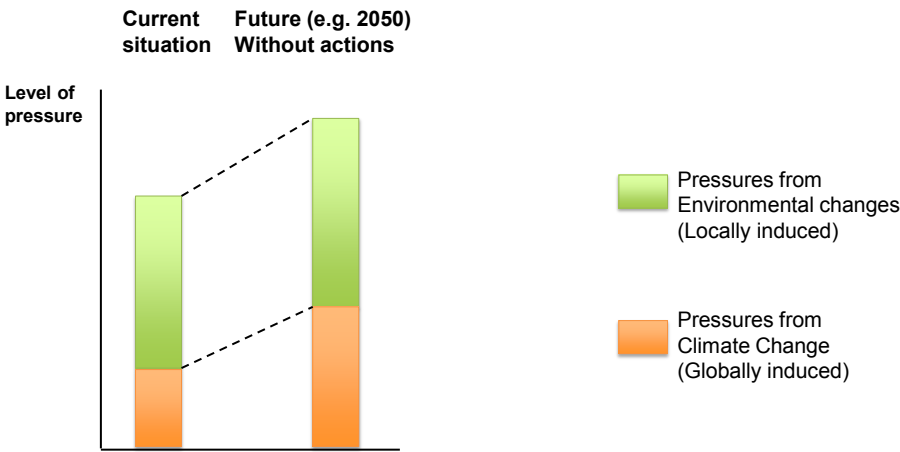
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Reduce local pressures

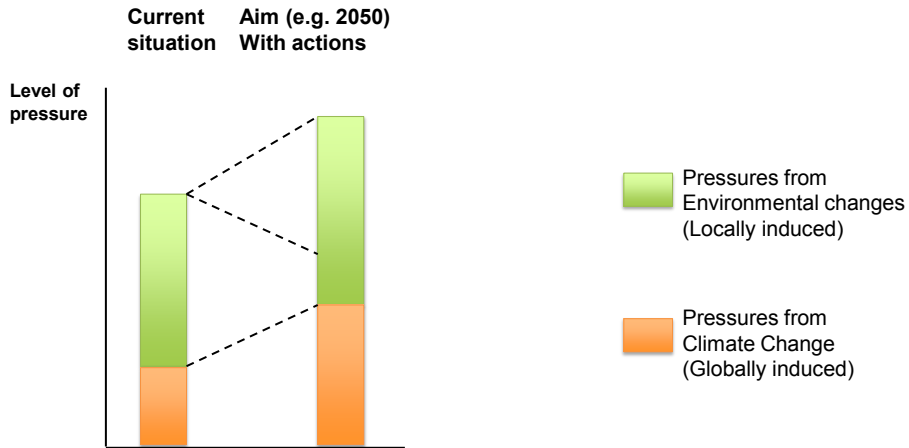
Current situation

Future (e.g. 2050) Without actions



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Reduce local pressures



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2 Extreme events



Disasters are seen as fast events...



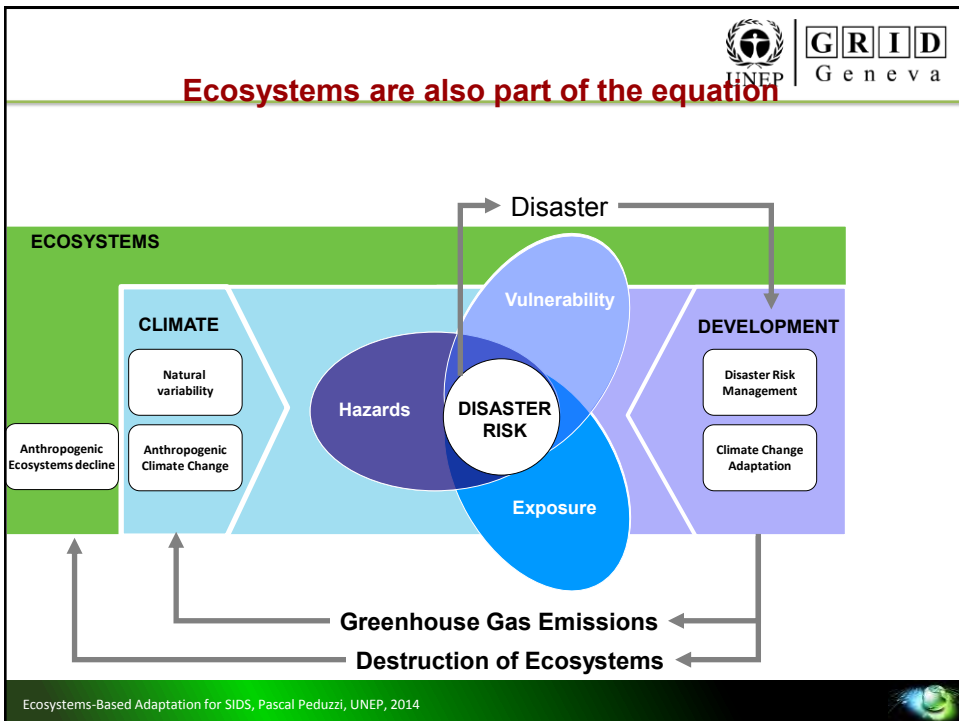
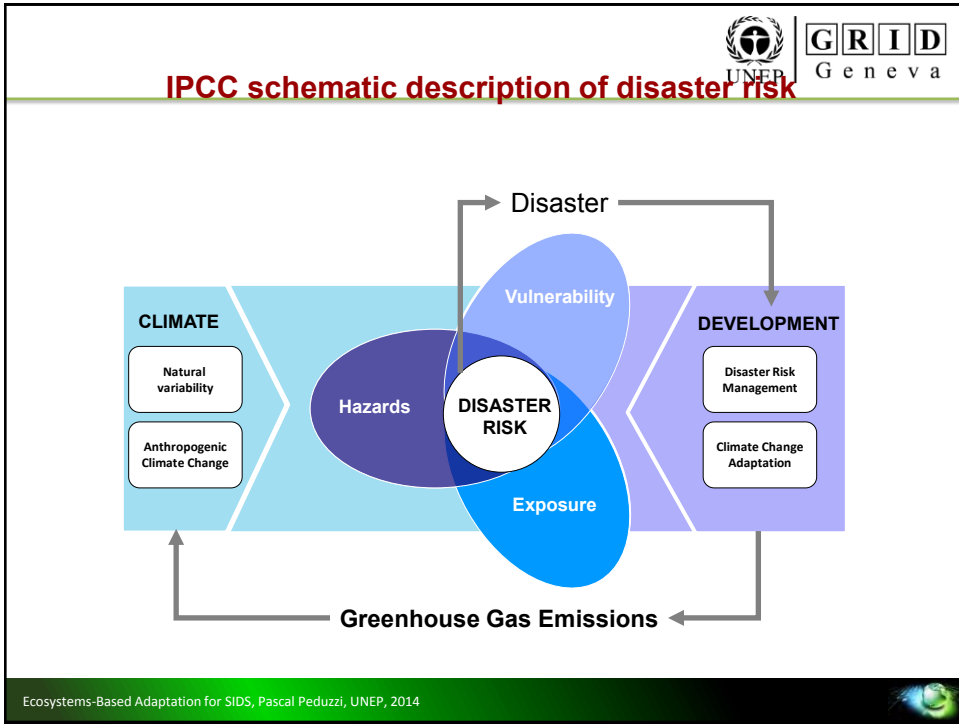
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...but disasters are slowly built

They are the consequences of slow / continuous processes resulting from inappropriate (or lack of) choices



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Ecosystems, Hazards and Resilience

RISK = HAZARD x EXPOSURE x VULNERABILITY

RESILIENCE



Ecosystems can increase the resilience of population
by providing services such as clean water, food supply (fish, fruits, crops)

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Ecosystems, Hazards and Resilience

Ecosystems: Can reduce frequency or / and intensity
Slope stabilization, buffering wave energy,
water infiltration,...



RISK = HAZARD x EXPOSURE x VULNERABILITY

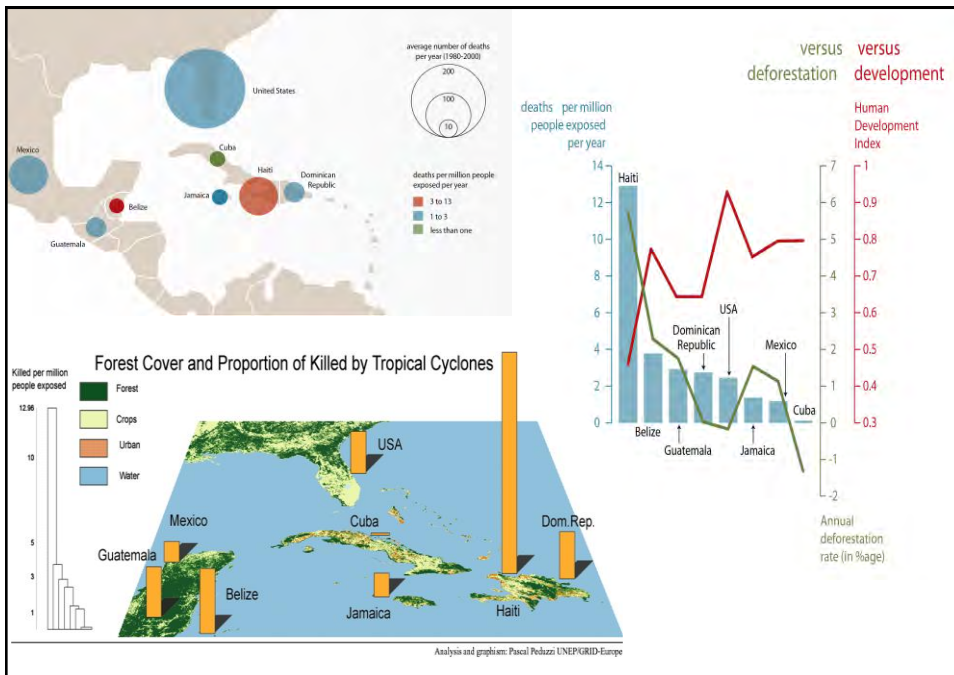
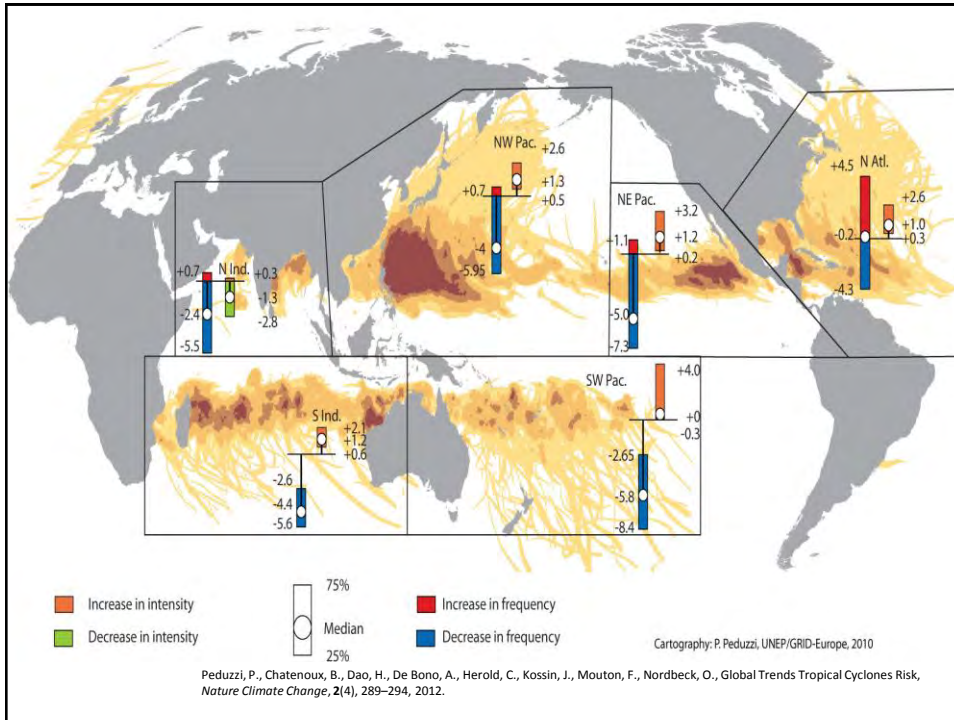
RESILIENCE

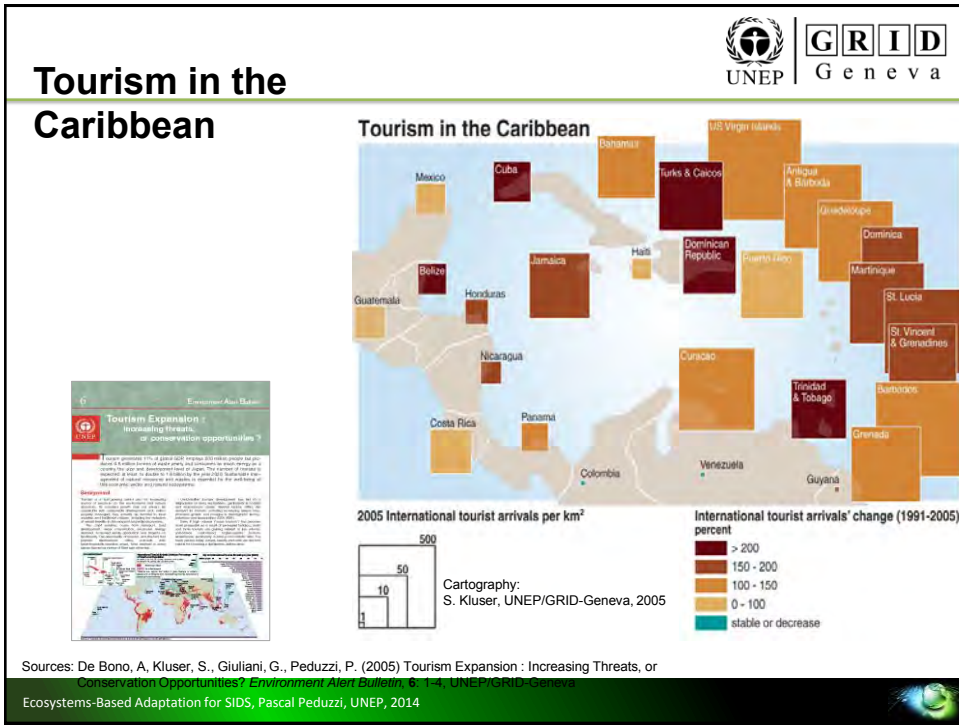


Ecosystems destruction
e.g. deforestation on slopes → landslides susceptibility
coral destruction → higher storm surge
Removal of vegetated areas in cities → bigger heatwaves and urban flooding

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Significant developments on coastal areas, pressure ecosystems, reduces their services, increases sedimentation and pollutants e.g. from sewages



Photo : © Ghaya Alghaya

Digging access for cruise ships

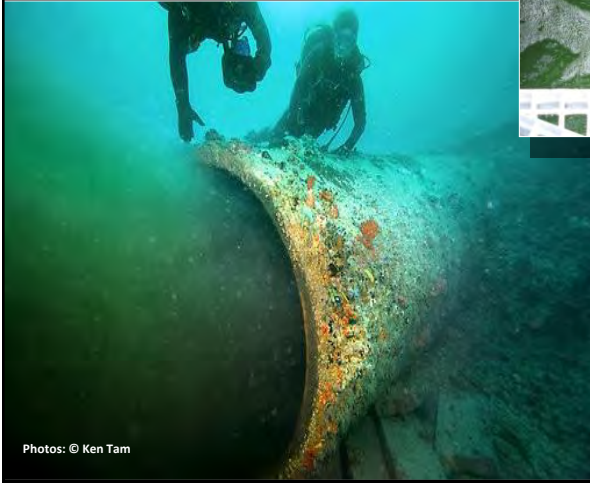


Photos : © Corporate Cruise Consultants

Pollution from “inappropriate”
sewage treatments
(or absence of)



Photo: © Peduzzi, 2010



Photos: © Ken Tam

Fisheries, agriculture & sand mining



Unsustainable fishing practices



Photo: courtesy WWF



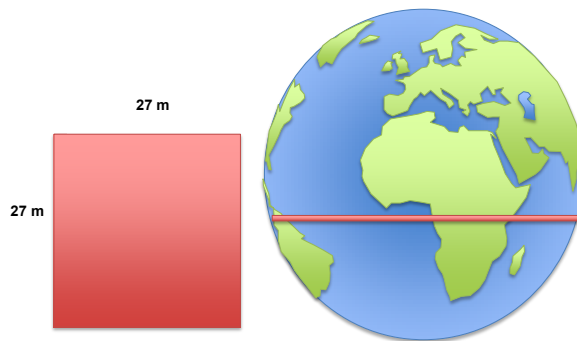
**Mangroves
conversion to
shrimps farm**





The global use of sand is about 30 billion tons /year

In one year:
this would be
enough to
build a wall of
27 x 27 m
around the
globe



Sand mining: Singapore



UNEP Global Environmental Alert Service (GEAS)
Taking the pulse of the planet: connecting science with policy

March 2014

Sand, rarer than one thinks

Sand and gravel are mined worldwide and account for the largest volume of solid mineral resources globally. Used by major economies such as thousands of acres (about 200), they are also being extracted at a rate far greater than their renewal. Furthermore, the industry being engaged in mining is highly impact on rivers, deltas and coastal and marine ecosystems. Figure 1 shows the loss of land through river reclamation in Singapore. The river factor and decrease in the amount of gravel being used, our increasing dependence on them and its significant impact that their extraction has on the environment, this issue has been mostly ignored by policy makers and remains largely unknown by the general public.

Why is this issue important?

Globally, between 47 and 59 billion tonnes of material is mined every year (Steininger et al., 2010), of which sand and gravel, hereafter known as aggregates, account for both the largest share (from 68% to 80%) and the fastest extraction increase (Krausmann et al., 2009). Surprisingly, although more sand and gravel are mined than any other material, reliable data on their extraction in certain developed countries are available only for recent years (Krausmann et al., 2009). The absence of global data on aggregates mining makes environmental assessment very difficult and has contributed to the lack of awareness about this issue.

One way to estimate the global use of aggregates indirectly is through the production of cement for concrete (concrete is made with cement, water, sand and gravel). The production of cement for concrete industry needs about six to seven times more tonnes of sand and gravel (USGS, 2013a). Thus, the world's use of aggregates for concrete can be estimated at 25.9 billion to 29.6 billion tonnes a year for 2012 alone. This represents enough concrete to build a wall 27 metres high by 27 metres wide around the equator.

Figure 1: Map of Singapore showing land reclamation from 1973 to 2013.

Figure 1 shows the loss of land through river reclamation in Singapore. The map displays land reclamation from 1973 to 2013, with a color-coded legend indicating different years: 1973 (lightest), 1979, 1989, 1993, 2003, and 2013 (darkest). The map shows a significant increase in land area over time, particularly in the southern and eastern parts of the island. A scale bar indicates 20 km.

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Forest ecosystems

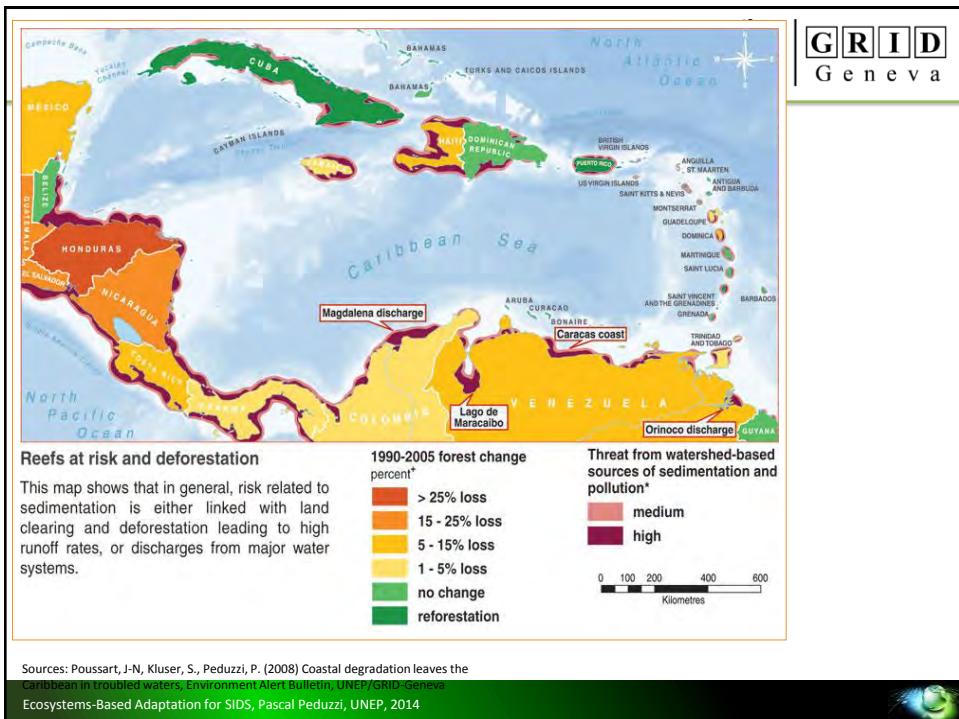
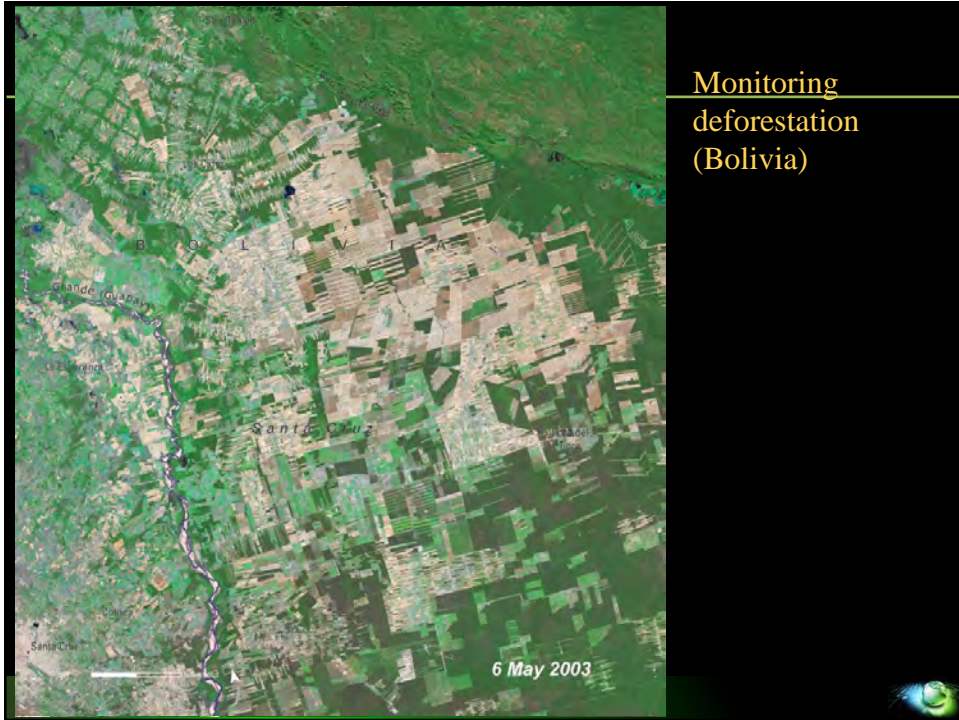




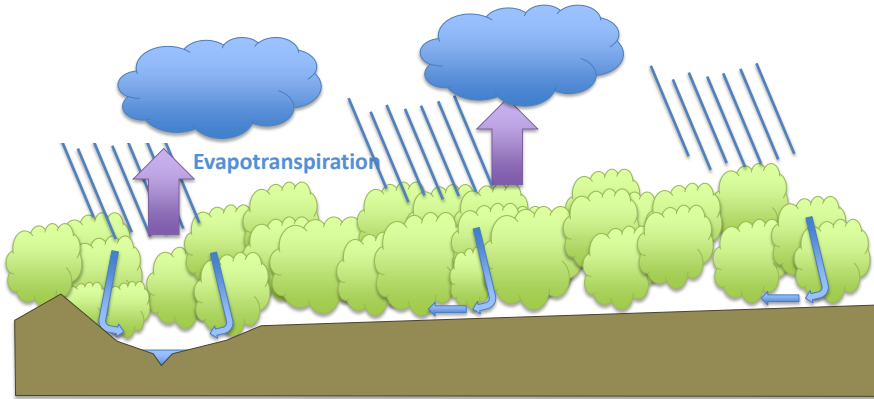
**Deforestation
13 million ha / year
globally**



**Deforestation
13 million ha / year
globally**



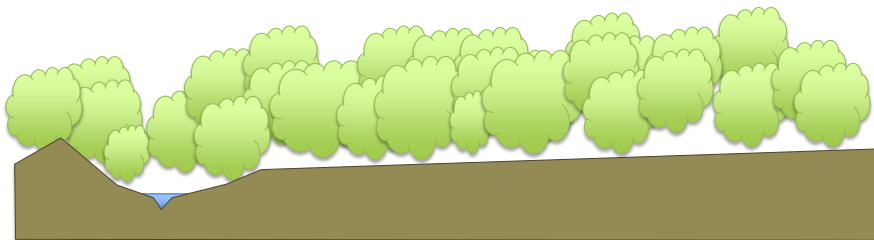
Forest helps the rain to go further inland,...



Ecosystems-Based Adaptation (EBA) in the Alps (Paolo Paronzo), UNEP, 2014



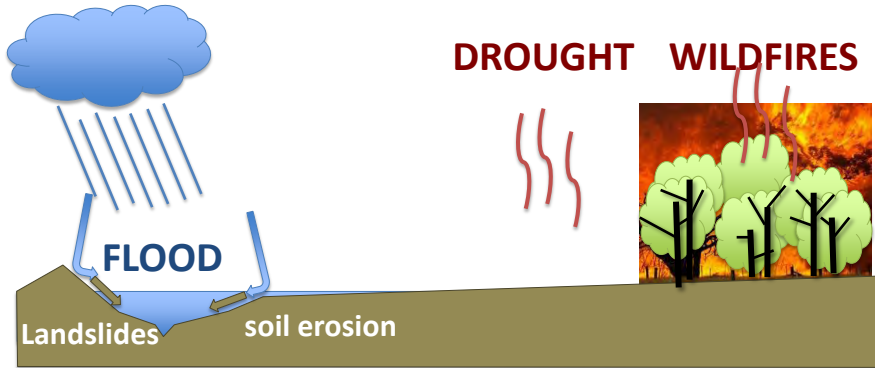
... but with deforestation,...



Ecosystems-Based Adaptation (EBA) in the Alps (Paolo Paronzo), UNEP, 2014



... extremes events are more frequent & intense



this process enters a loop, expending it further



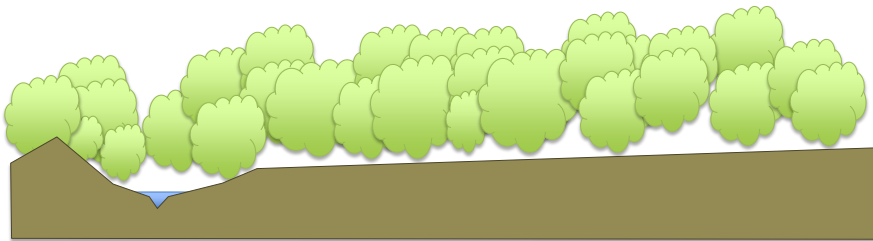


Drought can be a factor contributing to human-ignited forest fires, which can lead to widespread deforestation and carbon emissions (p.252)

Deforestation



Reforestation can solve this problem



RiVAMP : Identifying and quantifying the role of ecosystems

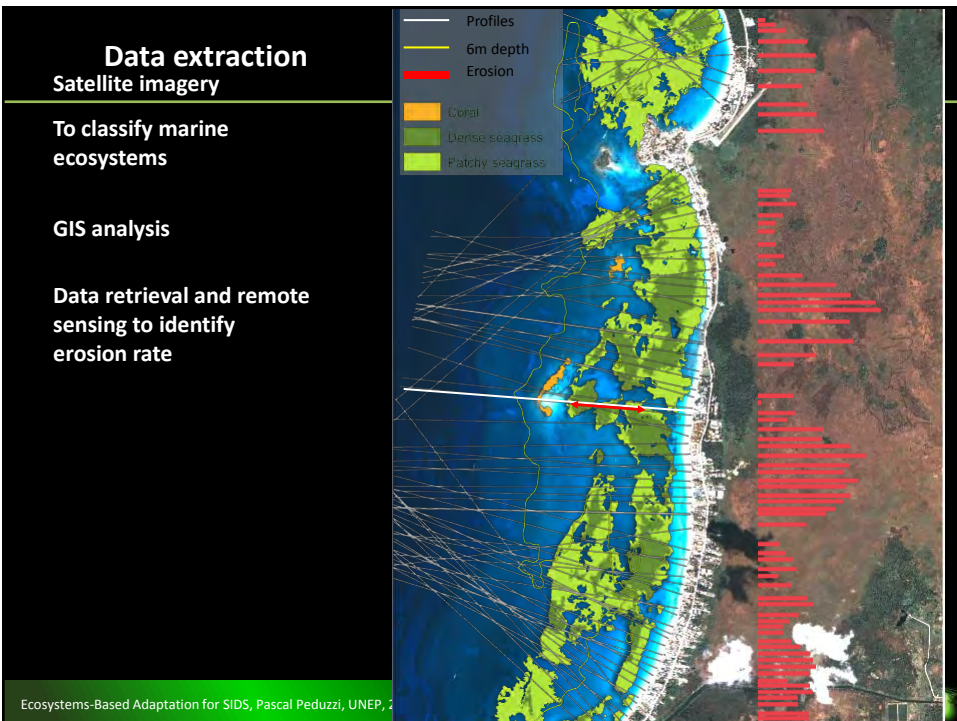
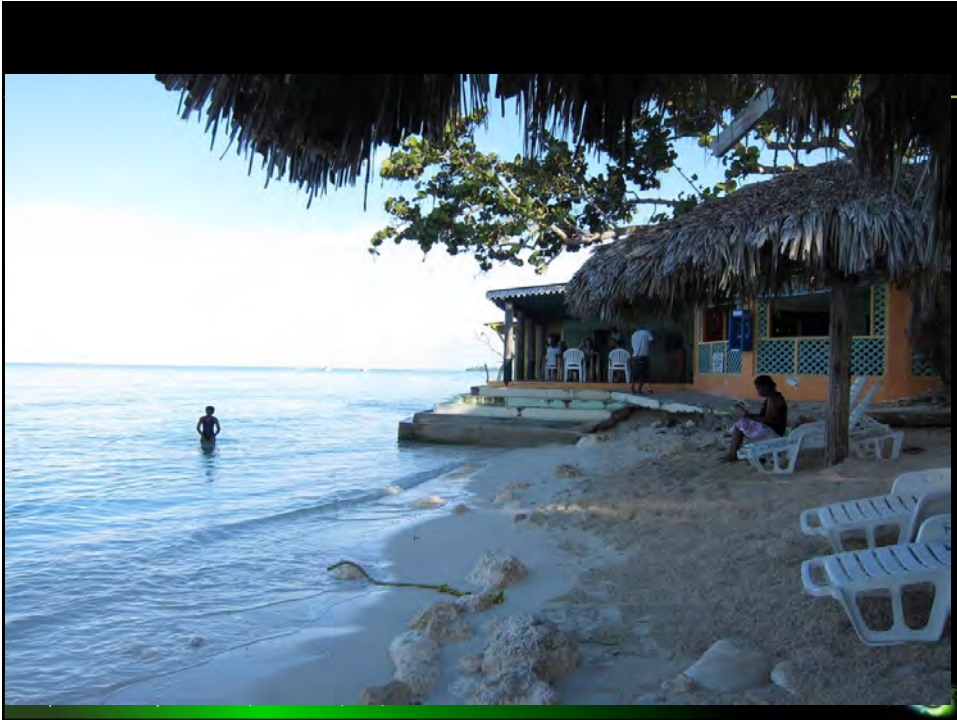


Negril

Erosion rate between 1968-2006 : 0.5 and 1 m/yr
 (large temporal and spatial variability; Smith Warner International, 2007)

Observation 2006-2008, shows that beach erosion continues (UNEP, 2010)

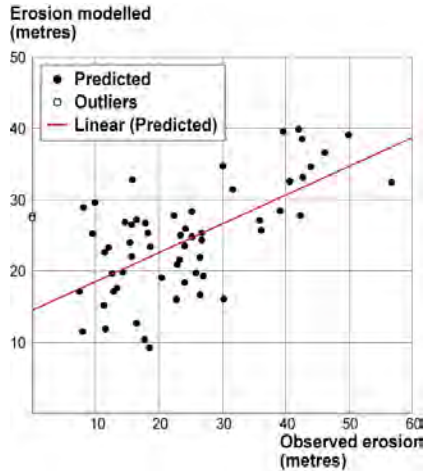




Multiple regression analysis



Erosion rate behind sea grass



The model explains 41% of the erosion (correlation $r=0.64$).

Sea grass, slopes and waves were selected as significant parameters in the model. **Sea grass plays the main role (47%)**: the wider the sea grass the less the erosion.

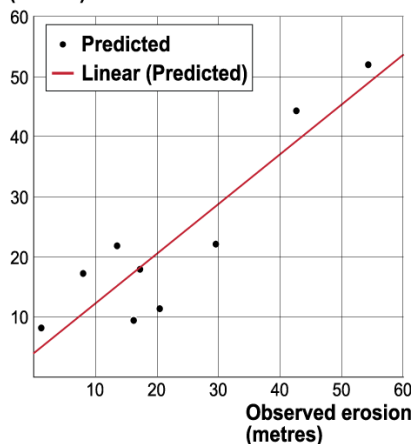
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Multiple regression analysis



Erosion modelled (metres)

Erosion rate behind coral



The model explains 83% of the erosion (correlation $r=0.91$).

Coral width and slopes were selected as significant parameters in the model. **Width of coral plays the main role (59%)**: the wider the coral the less the erosion.

Coral is 23.5 times more efficient than sea grass at mitigating beach erosion.

Coastal ecosystem importance: beach protection by seagrass meadows

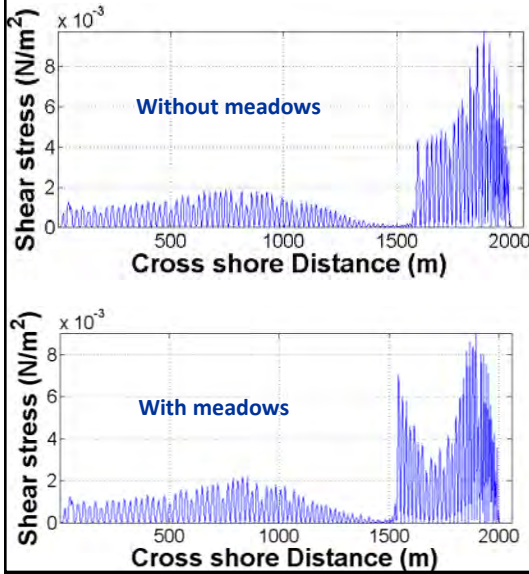


Fig. 11. Modelled bed shear stress (force per unit area) (SBEACH mode (wave height 1 m, period 6s) in the Negril coastal zone

The seagrass meadows spread the wave force on wider area and dissipate wave energy

Coastal ecosystem importance: beach protection by coral reefs

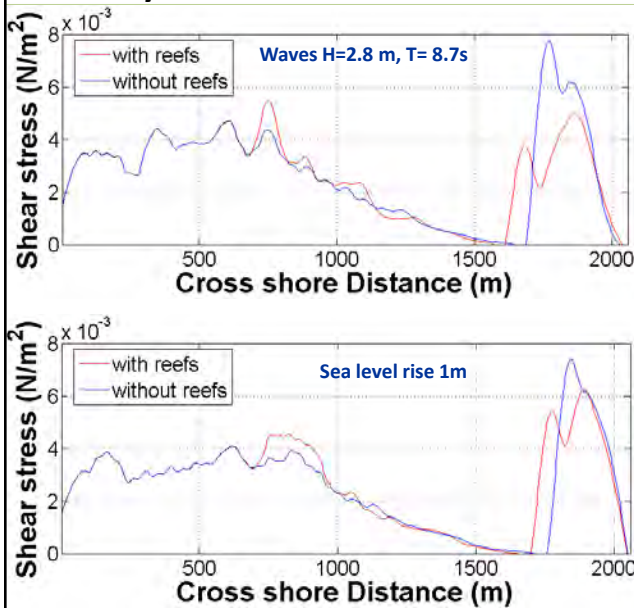


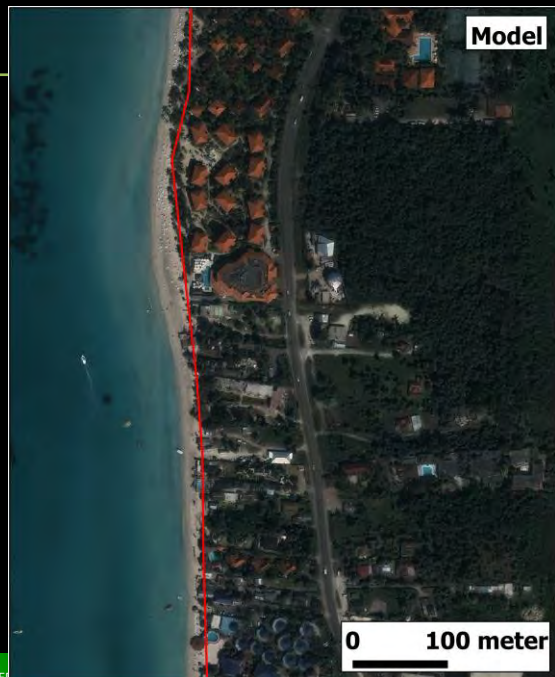
Fig. 9b. Modelled bed shear stress (force per unit area) (SBEACH model) induced by waves in the Negril coastal zone, showing the protection effects of inshore coral reefs

Coastal Ecosystems-based Adaptation for SIDS, Pascal Peduzzi, UNEP, 2014

Results from RiVAMP

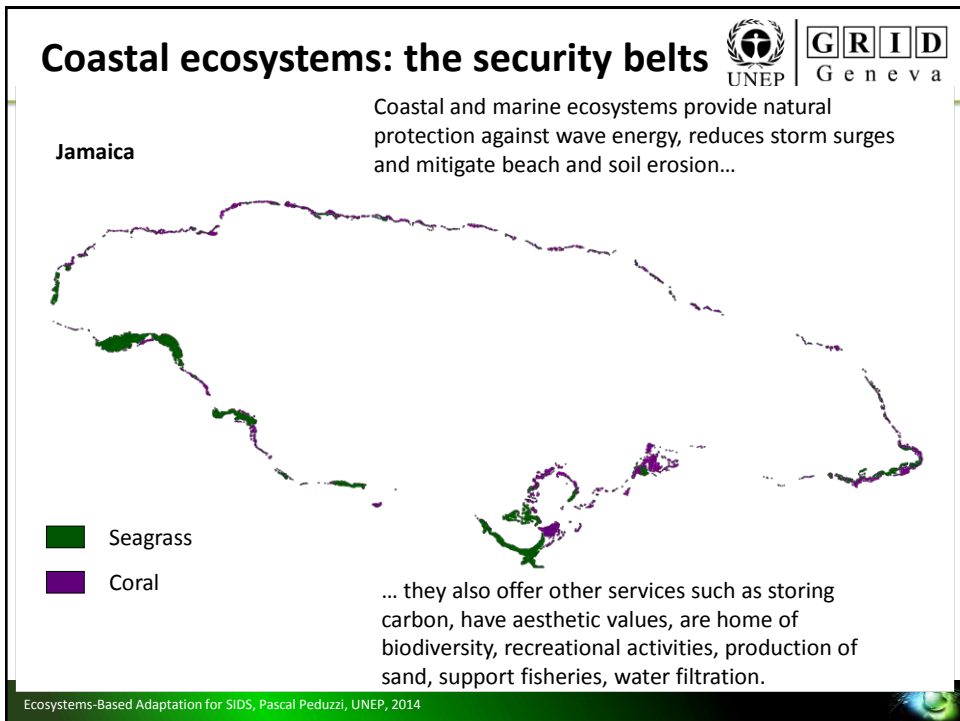
- Climate change “only” account for 9 %
- Destruction coral (lack of sewage, sediments,...)
- Daily removal of seagrass
- Conversion of the Morass to crop land

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Ecosystems-Based Adaptation for SIDS, Pascal Peduzzi, UNEP



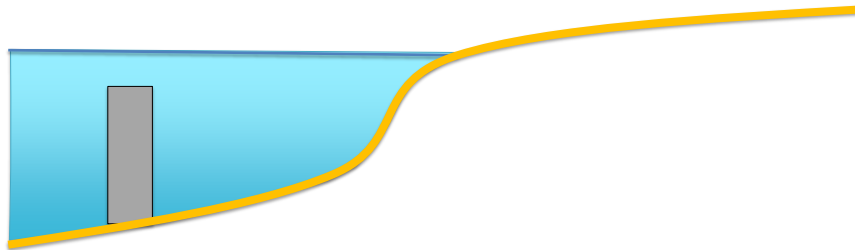




Combining Green & Grey



- Grey infrastructures are sometimes more appropriate,...



Combining Green & Grey



- Grey infrastructures are sometimes more appropriate...
- ...the combination of Green and Grey should also be considered.



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Airport & sea level rise: Barbados



Sea level rise & airport: Solomon islands



Sea level rise & airports: Kingston (Jamaica)



Impacts on harbours and coastal airports: concerns for **SIDS** connectivity.

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Panama canal



- In 2009, nearly 300 million tons of shipping.



- Every lock going downward requests more than 100,000 m³ of water to operate.
- Water management is a critical issue, both floods and droughts need to be controlled.



Sea level rise & coastal erosion: roads



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Landslides and deforestation



Protecting forest cover and reforestation may reduce landslides susceptibility.

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Wall for stabilizing slopes?



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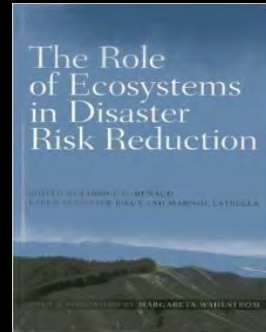
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Ecosystems: the “no regret option”

- ✓ Natural and environmental friendly
- ✓ Cost effective
- ✓ Easy, can be done with local population
- ✓ Low (if any) maintenance
- ✓ Esthetical value
- ✓ Carbon storage
- ✓ Support biodiversity
- ✓ Multiple services



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IPCC conclusions on anthropogenic climate change

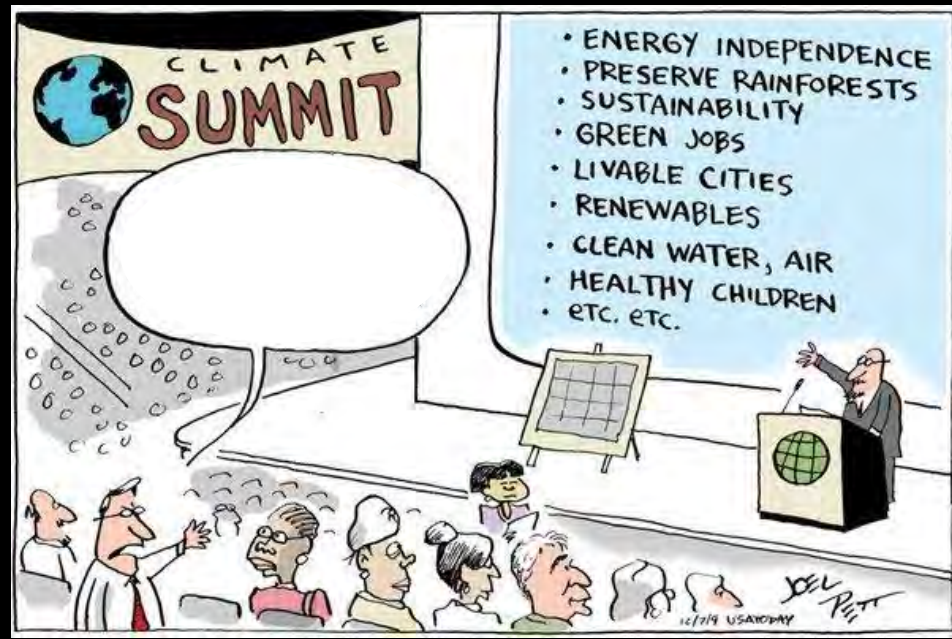


- TAR, 2001 → Likely (>66%)
- AR4, 2007 → Very Likely (> 90%)
- AR5, 2013 → Extremely likely (>95%)

We do not need to wait until this is virtually certain (99%) to take actions!

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The “no regret” option:



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