Resilence and limits of environment

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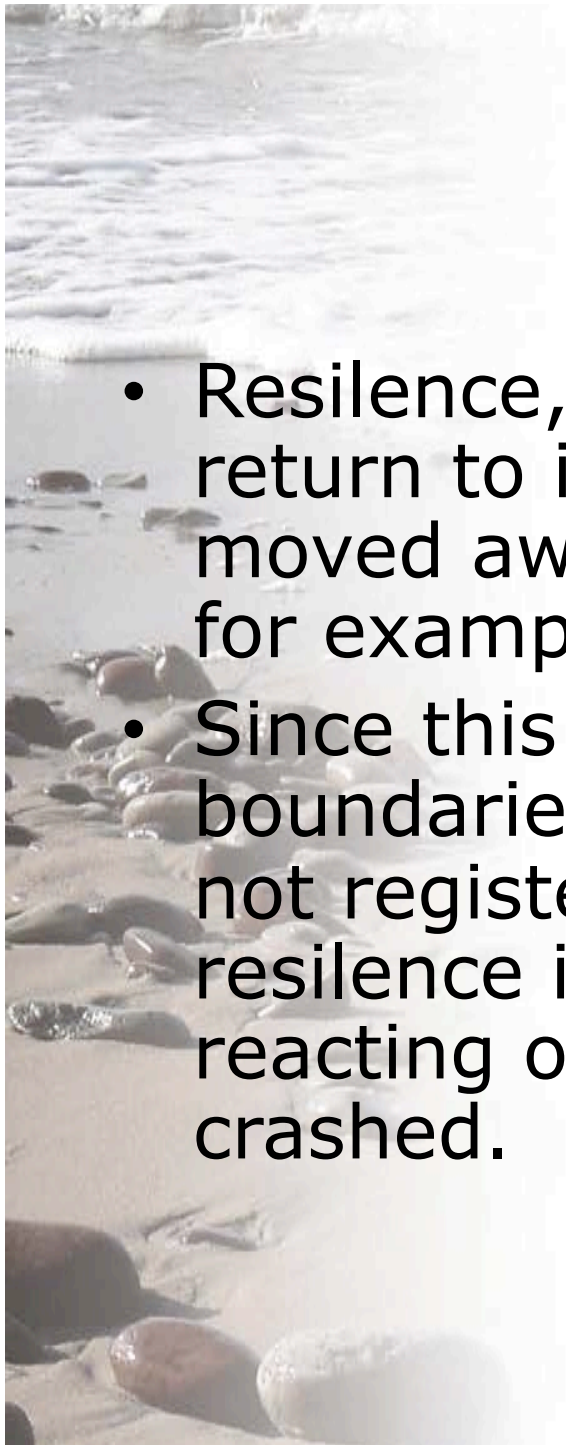
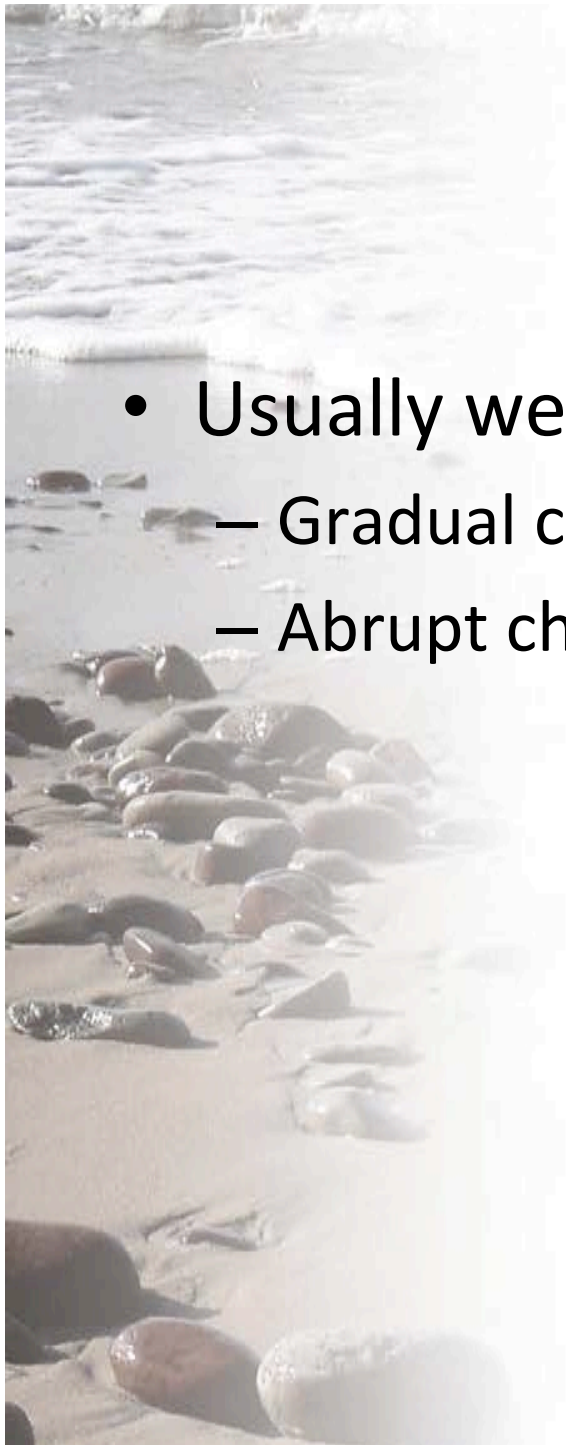


Resilence

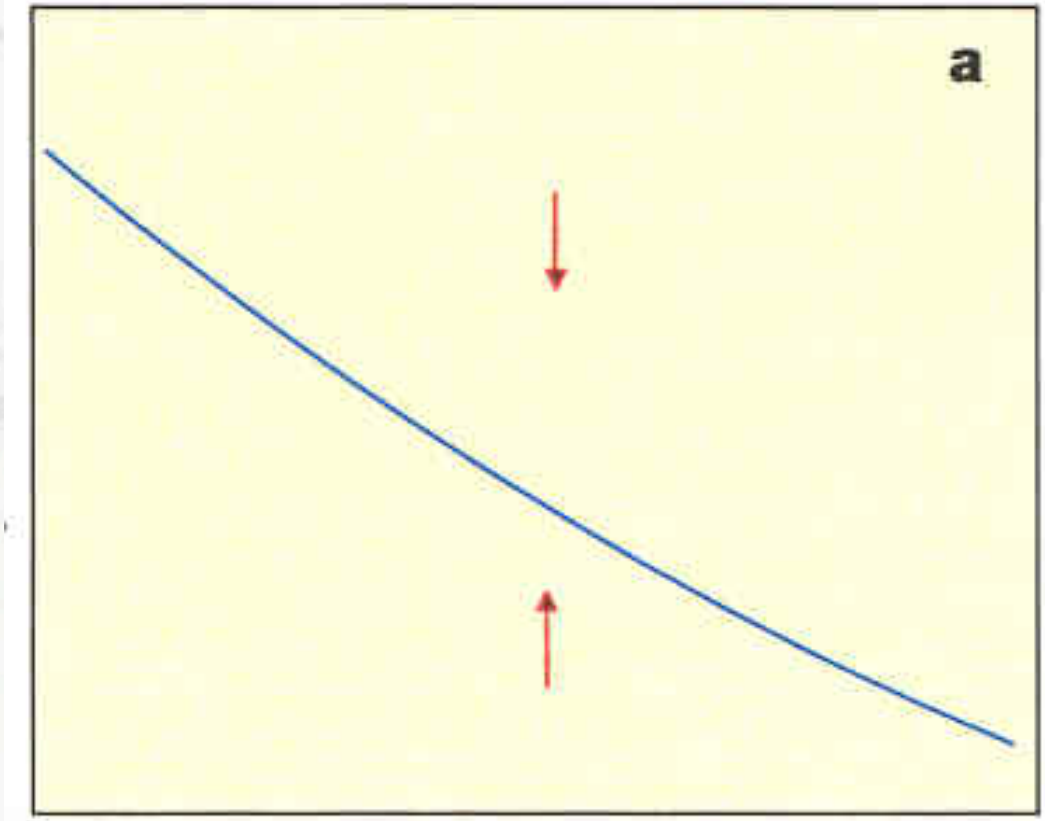
- Resilence, it is ecosystems capacity to return to initial state after it has been moved away from it by external forcing – for example pollution event.
- Since this “resilence”, it’s critical boundaries, is invisible quite often we are not registering first signals that the resilence is beeng exceeded and are reacting only when ecosystem has crashed.



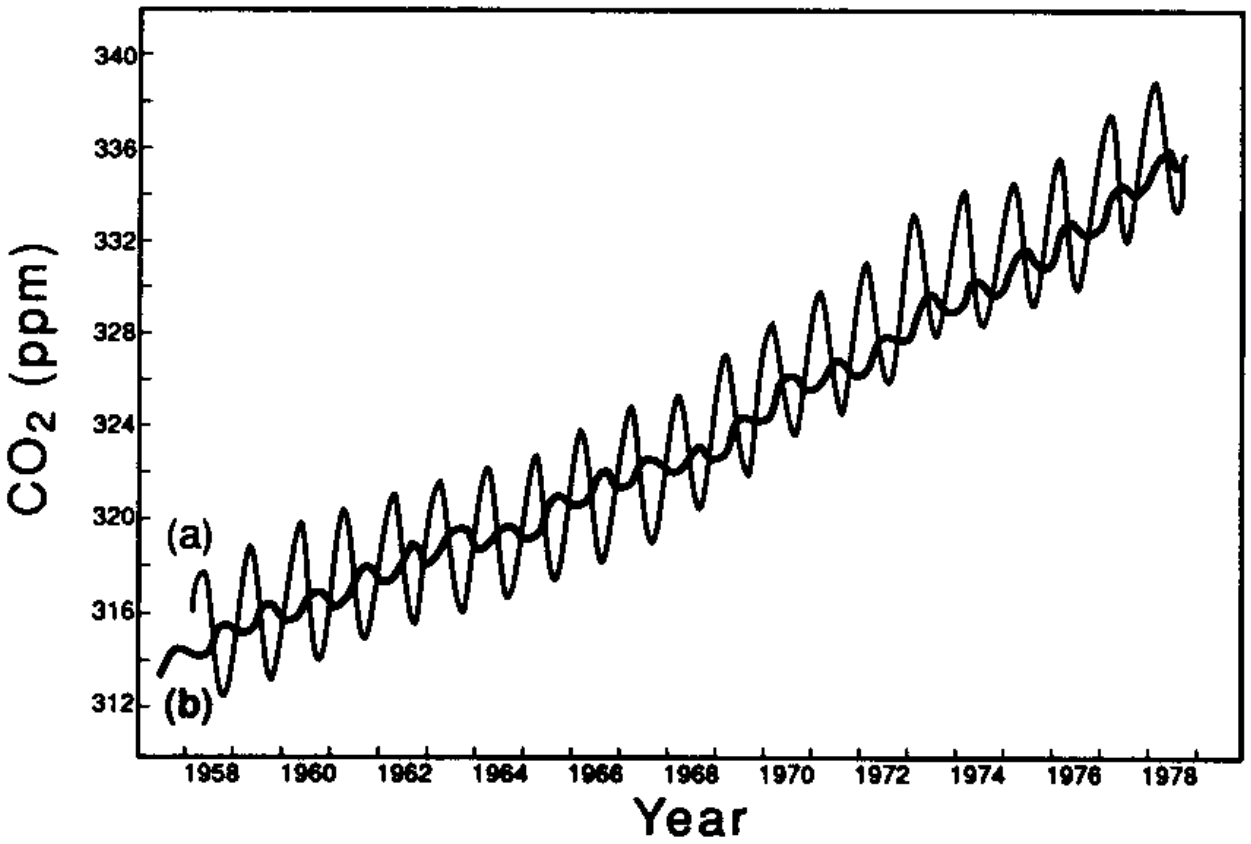
For introduction

- Usually we distinguish two types of changes:
  - Gradual change
  - Abrupt change

Gradual change

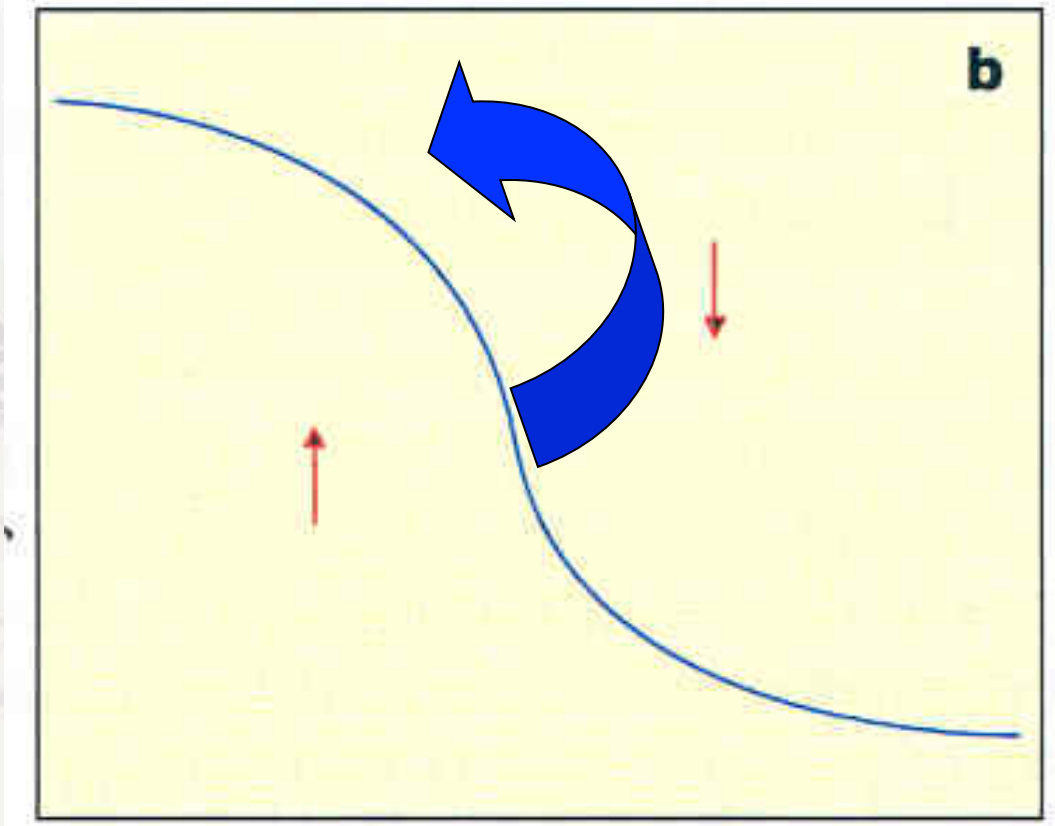


For example CO_2 concentration in atmosphere



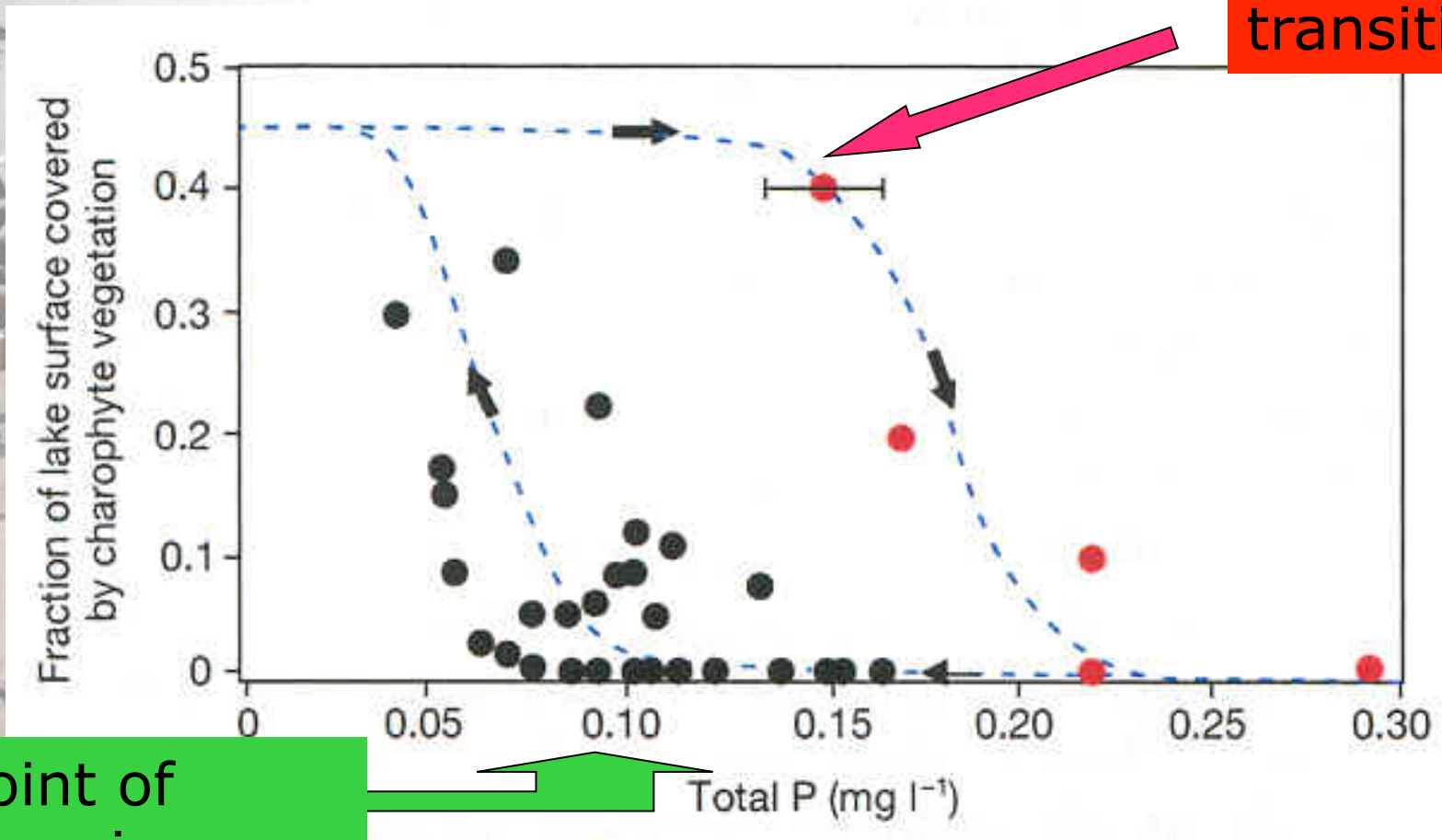
280 ppm → 370 ppm

Abrupt change

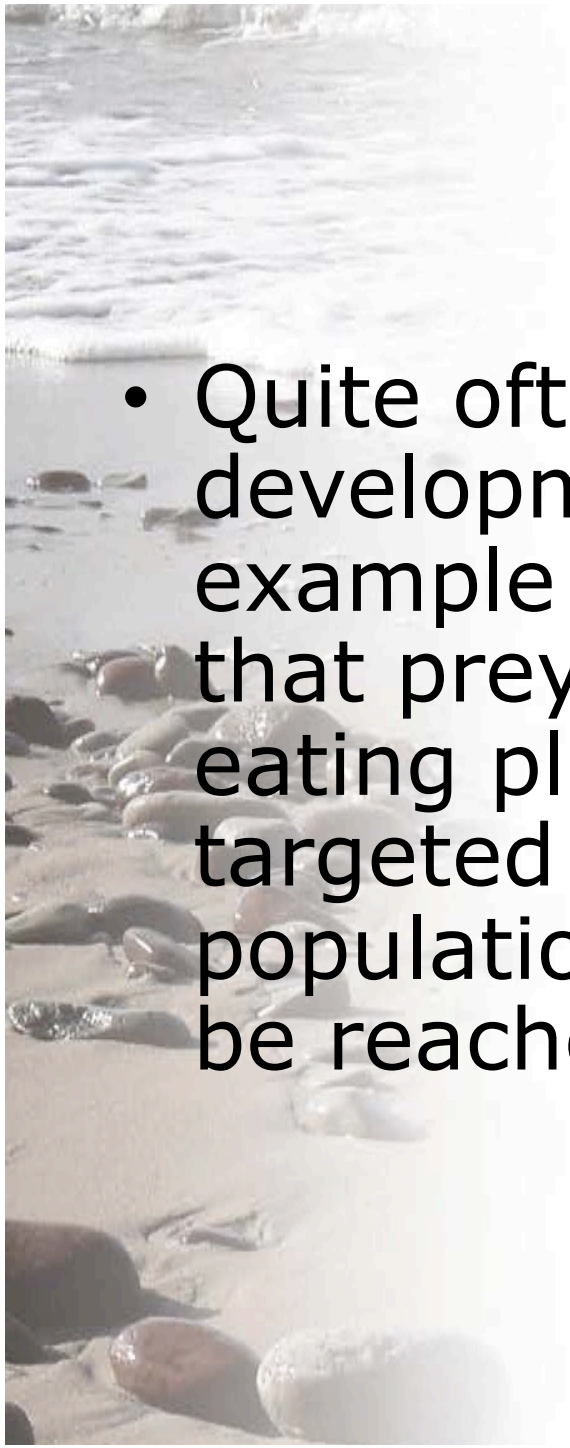


In this case there are some unexpected surprises

Point of transition



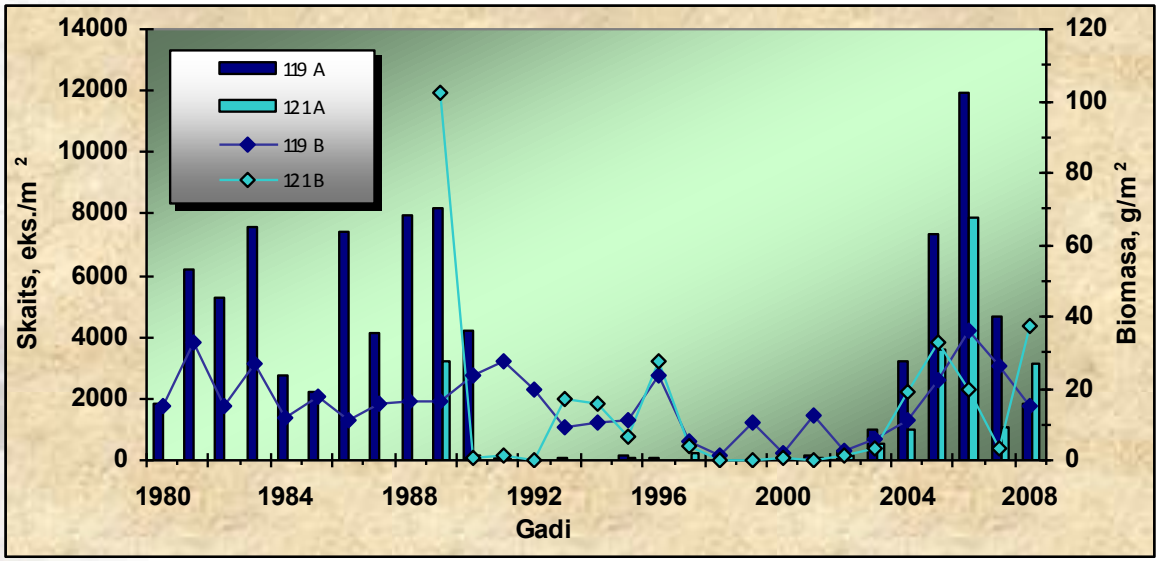
Point of reurning



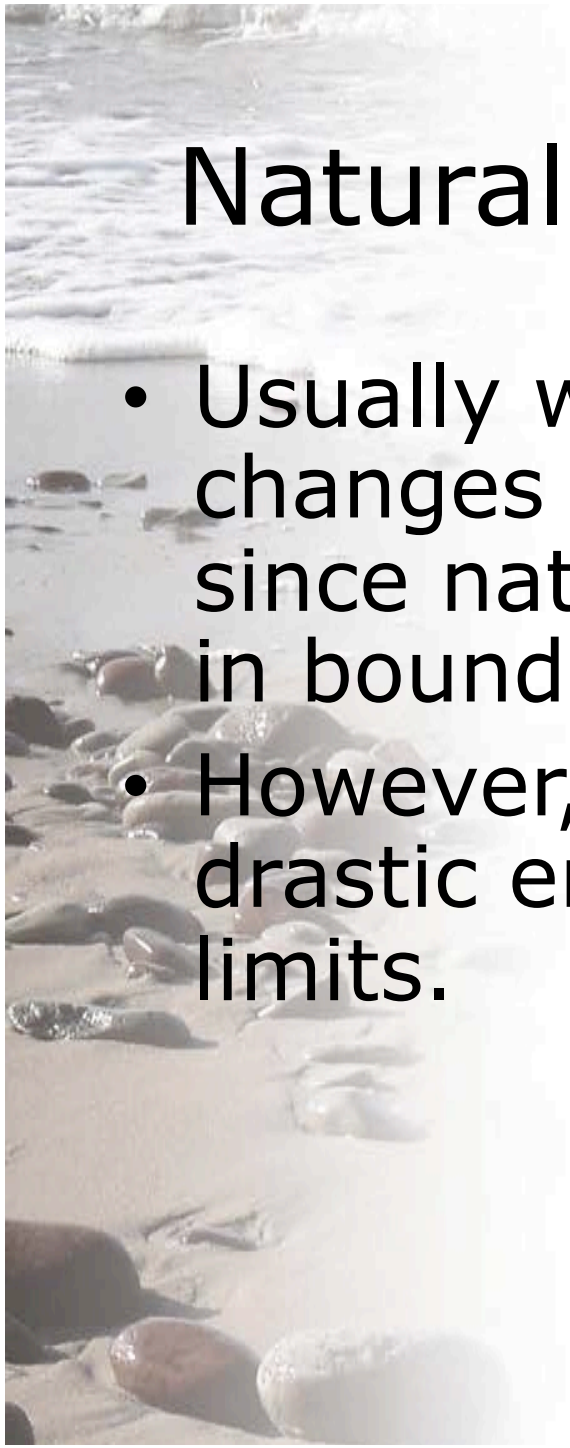
Why it is so

- Quite often changes involve development of new situation, for example population growth of fish that prey on organisms that are eating plankton. So, if there is no targeted activity to decrease fish population the previous state can not be reached.

For illustration



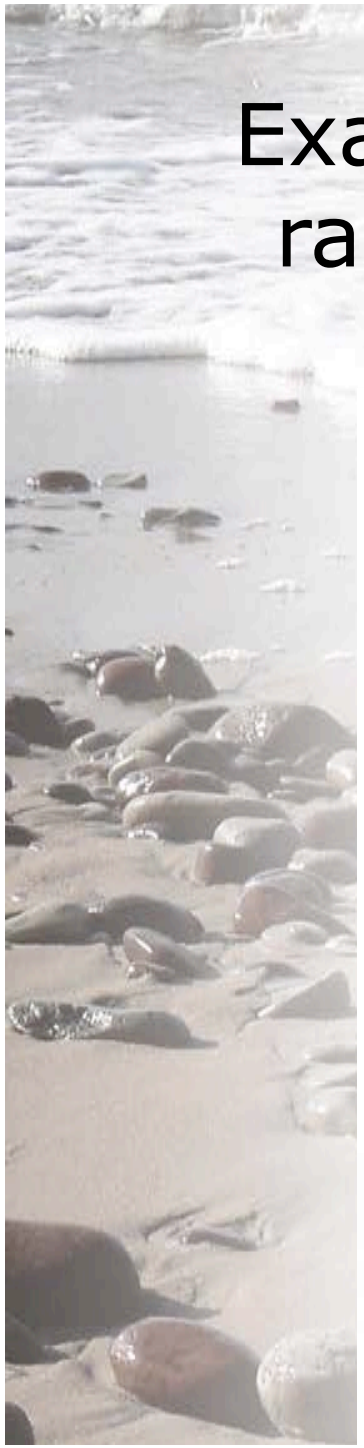
Macrozoobenthos long term changes in the Gulf of Riga



Natural versus anthropogenic

- Usually we atribute all unwelcome changes to anthropogenic forcing since natural fluctuations are mostly in boundaries of resilence.
- However, even natural events can be drastic enough to exceed resilence limits.

Example when due to change in Solar radiation Earth get one more desert



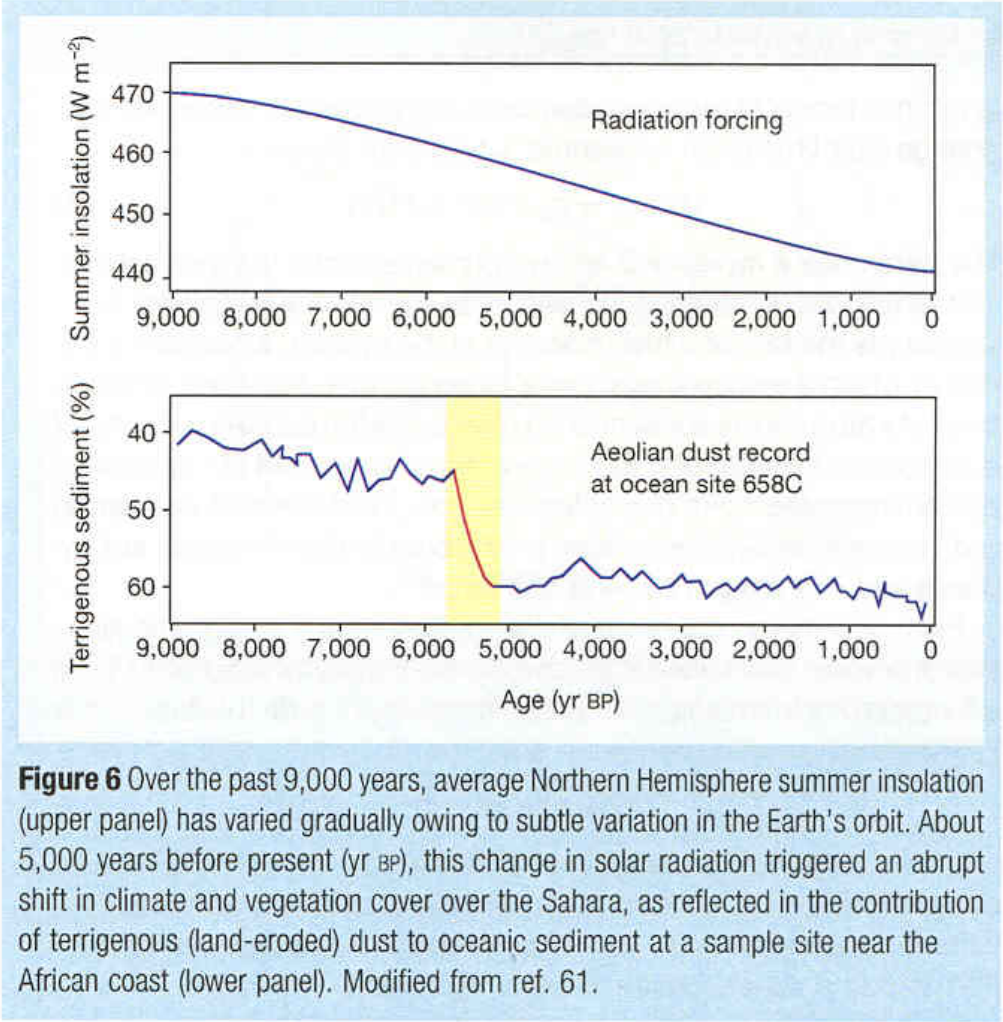


Figure 6 Over the past 9,000 years, average Northern Hemisphere summer insolation (upper panel) has varied gradually owing to subtle variation in the Earth's orbit. About 5,000 years before present (yr BP), this change in solar radiation triggered an abrupt shift in climate and vegetation cover over the Sahara, as reflected in the contribution of terrigenous (land-eroded) dust to oceanic sediment at a sample site near the African coast (lower panel). Modified from ref. 61.

THANK YOU