Tools to measure and monitor coastal drivers, resource use and health

Indicators of societal driving forces and pressures on coastal resource use

Issues	Indicators	Policy relevance	Functional relationship to ecosystem vulnerability
Population movements: ▪ In-migration, ▪ out migration, ▪ seasonal in migration	• Net migration rates (%p.a) Low: < 1.5 Moderate: < 3 High: > 3	Emplt. Available Unemplt/env. Stress Avail. Of jobs	Vulnerability – as in-migration –
Occupational shifts • Movements across economic sectors	• % shift	Degree of urbanisation, modernisation	Vulnerability – as less attention to resource base
Household earnings	• income per month	Command over goods & services	
Land use change • changes in distribution of land under various activities	• Change in % under primary activity • % increase in land transactions	Highlights : productive, protective, speculative use of land Reduced diversity of use for land	Vulnerability – as diversity –
Urban settlements	• % population in urban areas	Pop pressure & stress on ecosystems	Vulnerability – as congestion –
Density of population	▪ persons/sq km	Pop pressure & stress on ecosystems	Vulnerability – as density –
Annual withdrawal of Ground water	▪ % of avg. annual available water	Availability of water	Vulnerability – as GW balance –
Consumption of water	▪ lpcd basic: 40 average: 150 tourist needs: 500	Availability of water, waste of water	
Fertilizer use	▪ kgs/ha	Potential for impacts on enclosed/semi-enclosed environment	Vulnerability – as use –
Pesticide use	▪ kgs/ha	High use may result in adding persistent organic chemicals to ecosystem	Vulnerability – as use –
Solid waste generation • by activity •	▪ kg/d	High consumption of materials, need for disposal sites	Vulnerability – as waste generation –
Waste Water Generation • by activity	▪ litres/d	Implications for ground and surface water if sewage is untreated	Vulnerability – as waste generation –

Indicators of ecosystem health

Issues	Indicators or proxy variables	Policy relevance	Functional relationship to ecosystem vulnerability
Coastal vegetation ▪ vegetation activity ▪ Biomass change ▪ Diversity change ▪ Fragmentation	▪ NDVI[1] ▪ LAI[2] ▪ Tbd ▪ NDVI fractal dimension	Facilitate risk assessment and planning for resource use	Vulnerability – as Greenness (NDVI)¯ Vulnerability – as diversity¯ Vulnerability – as FD values –
Ground water: ▪ Intrinsic vulnerability, Pollution risk, Recharge rate, High drainability, Pollution status	▪ DRASTC	Quantity and quality of water available for use	Vulnerability – as values –
▪ Sea water intrusion	▪ GALDIT[3]	quality of water available for use	Vulnerability – as values –
Coastal water			
• Quality , Usability of water	• BOD , DO (mg/l) • N, P and K (μmol/l) • *E.coli* in water, sediments (n/ml)	Enables an use classification of water Quality of water available for community needs	Vulnerability – as DO values ¯ and other values –
• terrestrial organic loads	• Direct viable counts in different seasons: pre, monsoon and post	Can be used as a monitor for effluent loads	Loads – when DVC –
• terrestrial inorganic loads	• Bacterial counts, phytoplankton, zooplankton, heavy metals	Potential for toxicity	Loads – when DVC¯, metals –
• Assimilation capacity	• Cell counts, diversity, chlorophyll in phytoplankton • Zooplankton in terms of numbers and type	Provides an indication of level of stress in water	Waste Assimilation capacity ¯ as values ¯
• Release of oil	• PHC (μg/l)	Toxicity affecting metabolic activity of flora and fauna	Toxicity – as values –

[1] This index is used as indicator of canopy structure), percentage vegetation cover, green leaf biomass (the net primary production or NPP that is the resultant of photosynthetic energy fixation), light absorption and photosynthetic activity, evapotranspiration

[2] . This parameter measures the plant canopy density and the optical depth in the stand

[3] This index measures Pollution risk due to seawater mixing due not only to aquifer vulnerability but also on the existence of significant groundwater pumpage in the proximity of the coast.