Integrated DPSIR Framework for Environmental & Human Health
Glossary

Drivers: Socio-economic sectors that fulfill human needs for food & raw materials, water, shelter, health, culture, and security. Some socio-economic sectors do not directly fulfill human needs, but instead build and maintain the socio-economic infrastructure. One approach is to derive Drivers from the North American Industrial Classification System (NAICS).

Food & Raw Materials Sectors provide food, fuel, and other raw materials, and include

- Agriculture & Aquaculture
- Oil & Gas Extraction
- Recreational & Commercial Fishing
- Forestry
- Mining & Quarrying

Water Sectors fulfilling human needs for water include

- Drinking water supply
- Irrigation

Shelter Sectors fulfilling human needs for shelter include

- Housing – home construction, real estate, single family & multi-unit housing
- Textiles & Apparel

Health Sectors fulfilling human needs for Health include

- Medical care – hospitals
- Pharmaceuticals and cosmetics
- Social assistance – child care centers
- Waste management – sewage treatment facilities and landfills

Culture Sectors fulfilling human needs for culture include

- Tourism & recreation – recreational fishing & hunting, beaches & natural lands,
- Education – primary & secondary education, colleges & universities
- Information – telecommunications, scientific research, biotechnology research & development
- Social organizations- churches, outreach groups, families

Security Sectors fulfilling human needs for security include

- National defense – coastal defense, munitions
- Public administration – government, courts, law enforcement

Infrastructure sectors provide the physical, organizational, and technical support for the economy to function and include

- Manufacturing & trade
- Transportation – air & road transportation, ship & boat operation, warehousing
- Construction & civil engineering – road, utility line, building, dam, and pipeline construction
- Finance & insurance – banks, insurance
- Utilities – electric power, natural gas
- Technical services – management of companies, repair & maintenance services, personal services

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Pressures: Activities of the socio-economic drivers that exert positive or negative pressure on the state of ecosystems and human health.

Landuse changes resulting from alterations of the natural landscape, typically associated with population growth, including

- Coastal development
- Land development
- Shoreline alteration
- Hydrologic modifications, including impervious surfaces
- Deforestation and devegetation

Discharges of pollutants may result from the operation of industries or vehicles, or the diffuse distribution of contaminants from agricultural lands, roads, or lawns through ground-water or storm-water run-off, and includes both

- Applied chemicals – use of fertilizers, pesticides, insecticides, and herbicides
- Atmospheric discharges – vehicle & smokestack emissions including greenhouse gas emissions, sulphur & nitrogen oxide emissions, volatile organic compound emissions
- Waterborne discharges – point and non-point source discharges including wastewater discharges, contaminant discharges, and impervious surface run-off
- Littering

Contact uses are human activities that lead to a direct alteration or manipulation of the environment, and include

- Physical damage – dredging & filling, boat gear & anchor damage, vessel groundings, trampling, movement of boats
- Biological addition – ballast discharge, release of non-natives, feeding, creation of artificial habitat
- Biological harvest – harvesting, fishing, accidental by-catch, clear cutting

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State: Status of the abiotic (physical & chemical) and biological (humans and other biota) components of the ecosystem. Chemical, physical and biological processes interact to affect different ecosystem components (*e.g.* chemicals, biological species) that can be measured by their attributes (metrics of quantity or quality). All biota incorporate community and population attributes, but human condition also incorporates individual-level and subpopulation-level attributes.

Abiotic state reflects the magnitude, frequency, and concentration of abiotic components of the environment including

- ***Physical variables*** – climate variables (air and sea temperature, precipitation, storms & hurricanes, drought), hydrology, ocean circulation patterns, turbidity, fire
- ***Chemical variables*** – contaminants, nutrients, pH, atmospheric CO2 levels, salinity
- ***Built environment*** – man-made physical structures, including household furnishings, construction components, fuels for heating, cooling and cooking, etc.

The abiotic environment influences the survival, growth, and distribution of living organisms in the Biological state.

Biological state includes the biological components of the ecosystem and their interactions, including humans. In general, this includes sessile plants or animals that provide the living habitat and base of the food web that supports higher trophic levels. Biological condition may be measured by individual- or community-level attributes.

Human condition reflects individual-level and community-level attributes.

- *Individuals*
    - *Personal characteristics- aspects of the individual person that contribute to vulnerability*
        - age,
        - gender,
        - ethnicity
- ***Body Systems*** – the condition (healthy or diseased) of key human body systems, derived from MERCK guide, including
    - respiratory system -asthma
    - digestive system -obesity
    - reproductive system
    - neurological system – mercury poisoning
    - skin & connective tissues
    - cardiovascular system
    - endocrine system
    - genetics – birth defects

- *Behavior* – human personal behaviors which contribute to personal vulnerability or determine the quality of the human habitat
    - Mobility – walking, climbing, lifting (?), or utilization or any mode of assisted transportation (e.g., automobiles, planes)
    - Self care – personal hygiene, smoking, eating habits
    - Domestic life – household cleaning, cooking habits
    - Relationships – marriage, offspring
    - Community, social, and civic life – friendships, religious or political activities;
- *Communities* – characteristics of the community in which humans live
    - Population size or density
    - Ethnic or genetic diversity
    - Socio-economic status

Other biota are biological species other than humans which may interact directly or indirectly with humans. Biota include living habitat (e.g. plants) and the species dependent on habitat for resources & shelter. Note that other biota could be described by individual-, population- and community level-attributes, as humans are, if such detail is warranted.

- *Living habitat* is includes sessile plants and animals which compete for space, light, and nutrients within the physical habitat, and generally form the basis of the food web as primary producers.
    - Desert – desert plants
    - Wetlands – seagrasses, mangroves, wetland forests
    - Grasslands – grasses, shrubs, trees
    - Forests – trees, understory plants
    - Reefs – oyster beds, stony coral, algae, sponges & anemones
    - Agricultural Plants, Gardens, & Green-spaces
- *Inhabitants* – the biota, typically animals, associated with and dependent on living habitat for resources & shelter
    - Birds & mammals
    - Reptiles & amphibians
    - Fish
    - Invertebrates – including shellfish, insects
- *Invasive species* compete with, prey upon, or alter interactions among native species. They may enter the system through intentional introductions, hitchhiking on human transportation (cars, boats) or other animals, or accidental release of pets, garden plants, or aquarium species. Invasive species (http://www.invasivespeciesinfo.gov) include
    - Aquatic species – including fish & aquatic invertebrates
    - Animals – including birds, insects
    - Plants – including grasses, shrubs, vines, and trees
- *Microorganisms and pathogens* may have benefits in ecosystem function, such as decomposers or mycorrhizae, or be disease-causing agents, and include
    - Bacteria
    - Fungi

- Viruses

Impact: Changes in the quality and functioning of the ecosystem or human condition have an impact on the welfare (well-being) of humans. Ecosystem services, in particular, are the benefits that ecosystems can provide. Other factors, such as human health, habitat, & behavior also contribute to human well-being.

Ecosystem Services: Functions and products of the ecosystem that benefit humans in the short term or long term. Services depend on the attributes of the ecosystem. The Millennium Ecosystem Assessment (*Hassan et al. 2005*) defined four categories of ecosystem services:

- ***Supporting services*** – biophysical processes that maintain the functioning of the ecosystem, and are necessary for the production of other ecosystem services, but may not have direct impacts to humans, including
  - Structure – Soil stabilization, wave energy attenuation
  - Nutrient & contaminant processing
  - Water cycling
  - Carbon storage & cycling – including primary production
  - Provision of food and habitat to critical species
- ***Regulating services*** – biophysical processes that regulate the ecosystem, including
  - Air quality regulation
  - Climate regulation
  - Water regulation
  - Erosion regulation
  - Water purification and waste treatment
  - Disease regulation
  - Pest regulation
  - Pollination
  - Natural hazard regulation
- ***Provisioning services*** – the biological, chemical, or products obtained or harvested from ecosystems for human use including
  - Water resources – including fresh water
  - Food resources – including finfish, shellfish, and hunting stock
  - Biochemical & genetic resources – for pharmaceutical development, or breeding of wild & controlled populations
  - Raw materials – including fuel, fiber, and ornamental resources
- ***Cultural services*** – include the nonmaterial benefits people obtain from the ecological integrity of ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including
  - Recreational value & ecotourism
  - Aesthetic value

- Cultural value
- Spiritual or religious value
- Social relations
- Sense of place
- Educational or knowledge value
- Research potential
- Untapped future potential

Human Well-Being – a quantification of the degree of fulfillment of basic human needs for food, water, health, security, culture, and shelter. The State of human condition (e.g. presence of diseases) and the provisioning of ecosystem services are major contributors to human well-being. Socio-economic drivers depend upon the availability of natural capital (ecosystem services) and function to maintain or improve human well-being.

- Health & safety – life span, medical costs, availability of food
- Prosperity – productivity, ability to work, ability to afford things we need (income)
- Cultural and Social Well-Being – "happiness", love

Response: Responses are actions taken by groups or individuals in society and government to prevent, compensate, ameliorate or adapt to changes in well-being due to the state of the environment or condition of human health.

Driver-level Responses – attempt to modify the quantity, practices, or technology of socio-economic sectors;

- Energy Management
- Agriculture and Aquaculture Management
- Health Management
- Transportation/Construction Management
- Manufacturing & Trade Regulations
- Tourism & Recreation Management
- Educational Reforms
- Government Actions & Politics

Pressure-level Responses – attempt to control the activities of socio-economic sectors which place pressure on the environment;

- Land-use Management – permitting, city planning
- Discharge Limitations – discharge regulations, technological improvements
- Resource-use Management – harvesting regulations, protected areas

State-level Responses – directly attempt to restore, modify, or maintain the condition of the environment or human health

- Monitoring, Remediation, & Restoration – directly quantify or modify non-human ecosystems; may including setting water quality or air quality standards;
- Human behavior modification – attempts to modify human behaviors which may be negatively contributing to personal health;
- Medical treatment – attempt to directly modify human health condition through medicines, therapy, or other treatments
- Technological improvements – attempt to reduce or remove hazardous factors from the built environment, such as through siting of buildings, choice of furnishings, green infrastructure, alternative energy, etc.
- Community planning – are actions designed to improve the economic status, cultural & ethnic diversity, or neighborhood structure of communities

Impact-level Responses – attempt to monitor or quantify human well-being

- Index Development
- Valuation of Ecosystem Services
- Taxation and subsidies

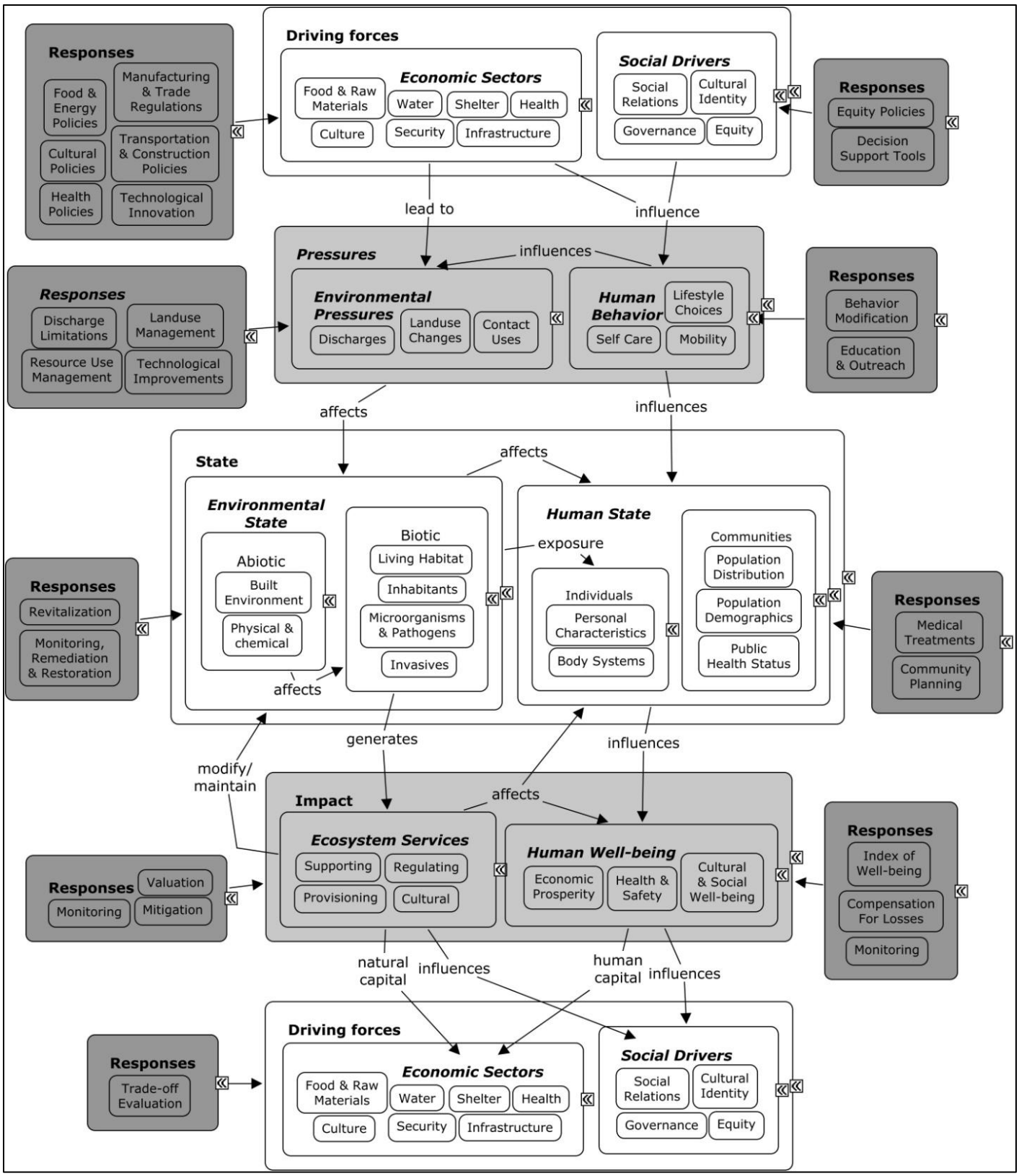

Figure 1. Generic Eco-Health DPSIR