

OVERVIEW OF ENVIRONMENT ISSUES IN THE MEKONG RIVER BASIN



MRB Ecological Resources

Ecological resources at most risk in the MRB are:

- Terrestrial Flora
- Terrestrial Fauna
- Aquatic Fauna
- Wetlands
- Special Ecosystems
- Biodiversity/Endangered Species
- Protected Areas

Terrestrial Flora

- Terrestrial ecosystems are being degraded as forest coverage, which supports much of the biodiversity of the Basin, declines
- In addition to declines in overall forest coverage, many remaining forest areas are of comparatively poor quality (i.e., low biomass density in plantation forests)
- Logging, shifting cultivation, agricultural and urban land encroachment, and fuel wood collection are major contributors to forest loss

Terrestrial Fauna

- MRB supports numerous populations and high species diversity of terrestrial fauna
- MRC survey indicated that at least 212 species of mammals, 696 species of bird and 213 species of reptiles and amphibians are present; new species are being discovered every year
- Development activities and unsustainable hunting represent a serious threat to populations and biodiversity in the MRB

Aquatic Fauna

- MRB supports significant aquatic fauna in terms of species composition and diversity (e.g., an estimated 1300 different fish species)
- Inland waters of the Mekong River in Cambodia, Lao PDR and Thailand and wetlands in Cambodia represent important breeding and nursery habitats for ecologically and economically important fish species
- Critical habitat are found in:
 - » the estuarine zone of the Mekong River Delta
 - » inland waters of the Mekong River

Wetlands

- Wetlands comprises a wide variety of permanently and temporarily wetted areas (e.g., estuarine marsh, flooded crops, natural lakes, and man-made reservoirs)
- Wetland habitats of greatest ecological importance in the MRB include:
 - » the Great Lake and Tonle Sap system in Cambodia
 - » the Plain of Reeds in Cambodia and Vietnam
 - » the Estuary Delta

Wetlands (Cont'd)

- Physical wetland functions include:
 - » water storage
 - » storm protection and flood mitigation
 - » shoreline stabilization and erosion control
 - » groundwater recharge
 - » retention of nutrients and sediments
 - » stabilization of local climatic conditions (e.g., rainfall and temperature)

Wetlands (Cont'd)

- Wetlands provide highly productive spawning and nursery habitat for wide variety of aquatic and terrestrial populations in the MRB - supporting ecologically and economically important fish and crustacean populations which are a major protein source for humans in riparian countries
- Wetland foodchains also support rare and endangered mammals, reptiles, amphibians, and resident and migratory birds

Great Lake and Tonle Sap River

- High significance to both ecologically and economically fish species (e.g., approximately 40 commercially-important species); flooded forest surrounding the lake is critical to the system's biological productivity
- Provides refuge for a wide variety of birds; several breeding colonies of large water birds utilize the system including some endangered species which are believed to use the area as breeding grounds (e.g., the Eastern Saurus crane)

Great Lake and Tonle Sap River (Cont'd)

- Concern about development pressures on the forest for the production of fuelwood and charcoal and conversion to agricultural land - forest coverage significantly reduced in last 20-30 years
- Overexploitation of fish from the lake, widespread use of highly destructive harvesting methods, and loss and degradation of habitat contributing to reduced capture rates

Biodiversity

- All lower MRB countries have high biodiversity:
 - » Cambodia (1st ranked) supports the best preserved biodiversity and richest wetland system
 - » Lao PDR (2nd) has lower species diversity covering large areas
 - » Thailand (3rd) has small pockets of extremely high biodiversity
 - » Vietnam (4th) has moderately high biodiversity in it's southern wetlands and Central Highland forests

Biodiversity (Cont'd)

- Richest biodiversity is generally located along country borders; biodiversity hot spots include:
 - » the border triangle of Cambodia, Lao PDR, and Vietnam
 - » along the Lao PDR and Vietnam border
 - » along the Cambodia and Thai border
 - » the border quadrangle of Lao PDR, Myanmar, Thailand and Yunnan, PRC
 - » along the Lao PDR and northeastern Thai border

Regional Biodiversity

| Feature | Lao PDR | Cambodia | Myanmar | Thailand | Vietnam | Yunnan |
|-------------------------|---------|----------|---------|----------|---------|--------|
| Mammals, total | 157 | 117 | 300 | 282 | 275 | 255 |
| Mammals, endemic | 1 | 1 | 6 | 8 | 5 | n/a |
| Birds, total | 609 | 545 | 1,000 | 930 | 744 | 766 |
| Birds, endemic | 3 | 0 | 3 | 2 | 4 | n/a |
| Freshwater fish | n/a | 850+ | n/a | 650 | n/a | n/a |
| Amphibians, total | 37 | 28 | 75 | 107 | 80 | n/a |
| Emphibians, endemic | n/a | n/a | n/a | 13 | n/a | n/a |
| Reptiles, total | 66 | 82 | 360 | 298 | 180 | n/a |
| Swallowtail butterflies | 39 | 22 | 68 | 56 | 37 | n/a |
| Insects | n/a | n/a | n/a | n/a | 6,000 | n/a |
| Vascular plants | 8,290 | 7,570 | 1,071 | 2,742 | 4,800 | n/a |
| Endemic plants | 1,457 | 1,175 | 1,071 | 2,742 | 4,800 | n/a |
| Ferns | n/a | n/a | n/a | 600 | 800 | n/a |
| Fungi | n/a | n/a | n/a | 3,000 | 600 | n/a |

Protected Areas

- Protection of rare and endangered species in the MRB is closely linked to the establishment of protected areas
- Existing protected areas cover approximately 61,493 km² or 8% of the MRB; this percentage is less than the international guideline of 12% of total country area but is gradually increasing
- MRB countries have been active in establishing transboundary protected areas to ensure that contiguous areas of habitat on each side of a border are protected but additional measures are needed

Protected Areas (Cont'd)

- Few protected areas are actively managed due to weak institutional and enforcement capacity in many countries which compromises effective management and achievement of conservation goals
- Protected areas fall into different categories:
 - » National Parks
 - » Wildlife sanctuaries/Nature reserves
 - » Protected landscapes/Cultural/Environmental
 - » Multiple Use areas

Protected Areas (Cont'd)

- A major dilemma faced by governments in establishing protected areas is in making trade-offs between maintaining ecological integrity and allowing consumptive uses of the land to continue
- Competing management priorities might include:
 - » maintenance of ecosystems
 - » preservation of species
 - » preservation of cultural heritage
 - » harvesting of economically valuable resources

Protected Areas in the MRB

| Country | Type of Protected Areas | Area, '000 ha | % of Total Area |
|----------|--|---------------|-----------------|
| Cambodia | Declared: 9 wildlife sanctuaries, 7 national parks (2 established), 3 protected cultural landscapes, 4 multi-use areas | 3,400 | 19.0 |
| Lao PDR | Declared: 20 national biodiversity conservation areas | 3,157 | 13.4 |
| Myanmar | Existing: 14 wildlife sanctuaries | 620 | 0.8 |
| Thailand | Existing: 78 national parks, 33 wildlife sanctuaries and 43 non-hunting areas | 6,500 | 12.6 |
| Vietnam | Existing: 8 national parks, 50 nature reserves (3 more proposed), 29 cultural/environmental protection areas | 980 | 3.0 |
| Yunnan | Existing: 33 protected areas | 730 | 5.2 |

Ecological Disturbances

- Ecological resources of the MRB have been diagnosed as **fair** to **poor** following a two-decade long period of economic growth in Thailand and post-war reconstruction in Cambodia, Lao PDR and Vietnam
- These activities have led to large scale, unsustainable resource exploitation in the MRB and have resulted in degradation of the Basin's ecological resources

Threats to Ecological Sustainability

- Human activities are impacting extensively on the integrity of the Basin's ecosystems, which are increasingly threatened by development
- Biodiversity in the MRB, which is among the richest in the world, is being impacted by habitat loss as a result of forestry, agriculture and hydropower development combined with excessive harvesting of wild flora and fauna
- The result is rapid declines in fish population, species diversity and wildlife populations

Threats to Ecological Sustainability (Cont'd)

- Pressures on environmental resources in the MRB are closely interlinked
- Factors such as poverty, insecure land tenure, human migration, and lack of environmental awareness, have combined to cause environmental degradation
- Natural resources have been exploited rather than conserved or harvested in a sustainable manner

Threats to Ecological Sustainability (Cont'd)

- Intensifying development in the Basin will further alter the physical landscape, integrity of its ecosystems and quality of life of its people
- **Development is inevitable**
- Therefore, sound management will be necessary to mitigate expected environmental and social impacts and to ensure the long-term sustainability of natural resources, the environment and quality of life of the Basin's people

Hydrological Change

- Hydrological regimes are subject to direct or indirect change as a result of development activities in the MRB (e.g., hydropower development, navigation improvements, water diversion, forestry, dredging and industrial and urban expansion)
- Undesirable impacts of development activities with respect to the hydrological regime include:
 - » Impairment of quality and quantity of water supply
 - » Degradation of critical fish habitat

Hydrological Change (Cont'd)

- Flood control measures (e.g., mainstream hydropower and water diversion schemes) have high potential to affect annual flood pattern and dry season flows
- To date, mainstream water diversion and hydropower projects have not been assessed for their Basin-wide hydrological impacts; recent efforts to examine development activities and consider cumulative effects of multiple projects within one country or individual projects in more than one country

Water Quality

- Deteriorating surface water quality in the MRB threatens resources and sustainability
- Pollution impacts include:
 - » Nutrients from agricultural run-off, industrial effluent discharges and domestic wastes can lead to severe eutrophication, especially in lakes
 - » Organic loadings from industrial, agricultural and urban development can negatively impact on aquatic organisms (e.g., depleted dissolved oxygen)

Water Quality (Cont'd)

- » Loadings of chemicals and metals from industrial effluent and urban waste water discharges and run-off can reduce drinking water and irrigation water quality and negatively impact on aquatic organisms
- » Increased sedimentation occurring as a result of land use changes such as agriculture, forestry, mining and urbanization can impact hydrological regimes, disturb aquatic ecosystems and fisheries, and affect navigation

Wetland Depletion

- ➔ Wetlands are increasingly impacted by economic activities, e.g.:
 - » harvesting of wetland trees and flooded forests occurs for timber, fuel wood, charcoal, construction materials
 - » clearing for agricultural use and fish capture
 - » coastal mangrove habitat is extensively cleared for shrimp cultivation
 - » encroachment by urban expansion and industrialization results in incremental loss of urban wetlands

Wetland Depletion (Cont'd)

- Destruction and degradation of wetlands can severely impact on fish and bird populations
- Continuing loss of wetlands in MRB countries is likely contributing to declining fish and bird populations and an overall reduction in biodiversity
- Of particular concern is the potential for degradation of important wetland systems (e.g., Great Lake and Tonle Sap River; RAMSAR designated wetlands)

Economic Development

- MRB riparian country economies, although impacted by overall economic recession in SE Asia, are expected to continue to grow rapidly
- Economic growth results in increased rates of resource use with corresponding intensification of pressure on sensitive natural ecosystems
- Management challenge is to benefit from economic growth through sustainable consumption of natural resources while limiting environmental degradation

Major Development Activities

Development activities in the MRB include:

- agriculture
- logging
- fisheries
- mining
- irrigation and water diversion
- hydropower
- transportation
- urban and industrial

Agriculture

- Agriculture is the predominant economic sector in the MRB (e.g., involving approx. 3/4 of population in Cambodia and Vietnam)
- Intensification of farming involving increasing use of agro-chemicals (i.e., fertilizers and pesticides) can have serious impact on surface and groundwater quality and health of both humans and animals; particularly persistent pesticides which, although effective, pose a serious long-term human health and environmental threat

Agriculture (Cont'd)

- Shifting cultivation widely criticized as a significant contributor to forest degradation and erosion; although traditional shifting cultivation is a sustainable practice, with increasing population densities, cultivation cycles become too short, land becomes less fertile and the practice becomes unsustainable
- Widespread clearing of forests for expansion of agriculture exacerbates erosion and soil problems caused by deforestation; farming of forests lands usually not sustainable due to declining yields in nutrient-poor soils

Forestry

- Rural populations depend predominantly on the use of fuel wood for their cooking and heating needs; impacts are generally much less severe than commercial logging
- Commercial logging operations pose a serious threat to forest ecosystems in the MRB; export demand for high-value logs and lumber provides the impetus for intensive logging in lower MRB countries
- Intent of logging bans and moratoriums has been largely frustrated by illegal or unregulated logging

Forestry (Cont'd)

- Afforestation rates are generally insufficient to compensate for forest depletion as a result of logging operations
- Second growth forests provide little of the biodiversity of virgin forest
- Logging impacts to aquatic and terrestrial fauna utilizing stream and river habitat not addressed by afforestation (e.g., monoculture forests typically do not provide beneficial forest cover preferred by aquatic and terrestrial fauna)

Forest Depletion

- Difficult to assess the **relative** impacts of human activities but **cumulative** effect of uncontrolled activities is clearly evident in all MRB countries
- Management responses have generally not been effective in addressing forest loss problem
- Consequences of widespread forest loss include:
 - » loss of wildlife and biodiversity
 - » damage to aquatic habitats and wetlands
 - » increased erosion and sedimentation
 - » disturbed hydrological regime

Fisheries

- Fishing and aquaculture are an important source of low-cost and high-quality protein for the people of the MRB as well as generating export earnings
- Major capture fisheries take place in:
 - » the Mekong River and its major tributaries
 - » the Great Lake and Tonle Sap River
 - » the floodplains extending downstream from Phnom Penh to the Mekong Delta in Vietnam
 - » reservoirs in Lao PDR and northeastern Thailand
 - » the brackish waters of the Mekong Estuary

Fisheries (Cont'd)

- Capture fisheries provide 90% of total production with culture fisheries making up remaining 10% but balance is shifting as capture fishery catches decline due to over-fishing and habitat destruction
- Issues relating to culture fisheries include:
 - » health and hygiene concerns related to traditional small scale culture fisheries
 - » poorly-planned commercial aquaculture can be unsustainable; leading to destruction of terrestrial flora and deterioration of surface water quality

Impacts to Fisheries

- Limited data is available of fisheries populations in the MRB
- Likely that unsustainable capture rates combined with impacts to habitats from development activities are severely stressing fish populations
- Populations are further stressed by declining water quality due to pollution and reduced flow rates as a result of water diversions for irrigation and dam construction

Mining

- Mining not yet extensive but likely to expand; Lao PDR has significant mineral resources; Cambodia and Vietnam also have exploitable resources
- Mining can have serious environmental impacts if operations are not properly regulated
- Potential impacts include:
 - » vegetation destruction
 - » landscape modification (i.e., aesthetic)
 - » surface and groundwater pollution
 - » air pollution

Mining (Cont'd)

- Regulation of mining activities is complicated and consequently made less effective by several factors:
 - » Lack of scientific understanding of potential environmental effects
 - » Non-comprehensive nature of environmental impact assessments
 - » Poor scrutiny of actual impacts during mining operations
 - » Inaccessibility of remote mine locations

Irrigation and Water Diversions

- Although irrigation development is widespread, large scale diversions have been confined primarily to the upper MRB
- Environmental impacts from major diversion projects include:
 - » hydrological changes
 - » downstream wetland and estuary ecosystems dependent on seasonal flooding may be impacted
 - » losses of inundated forests to create reservoirs
 - » resettlement of people

Hydropower

- The Mekong River has considerable hydropower potential (i.e., highest in east Asia)
- Main driver for hydropower development is demand for electricity, particularly in Thailand and Vietnam
- Hydropower projects have a high potential to cause environmental and social impacts
- Although dam projects can have positive impacts (e.g., flood control), careful consideration must be given to negative impacts

Hydropower (Cont'd)

- Fisheries are likely to be most severely impacted by hydropower development
- Potential impacts result from:
 - » water level fluctuations
 - » water quality degradation
 - » loss of spawning habitat through inundation
 - » loss of spawning and rearing habitat through changes in hydrology

Transportation

- Substantial transportation development is planned or proposed to facilitate development in the Greater Mekong Subregion
- The centrepiece of transportation development is the construction of road corridors:
 - » eastern seaboard connection between Bangkok - Phnom Penh - Vung Tau
 - » east-west connection between Thailand - Lao PDR - Vietnam
 - » north-south connection between Chang Rai - Myanmar - Lao PDR - Kuming, China

Transportation (Cont'd)

- ➔ Development of transportation links and associated infrastructure (e.g., bridges, power lines) has a high potential to cause environmental and social impacts such as:
 - » encroachment of pristine environments with resulting loss of biodiversity
 - » impairment of fisheries and aquatic ecology
 - » increased erosion and sedimentation
 - » loss of cultural values and/or tourism potential
 - » human resettlement
 - » air pollution

Urbanization and Industrialization

- Urbanization in MRB is relatively low at approximately 11% but is expected to increase significantly in the next decade as rural-urban migration continues
- Industrialization in the MRB has been limited compared to other SE Asian countries; this pattern is likely to change in the next decade as ongoing and planned infrastructure developments are completed

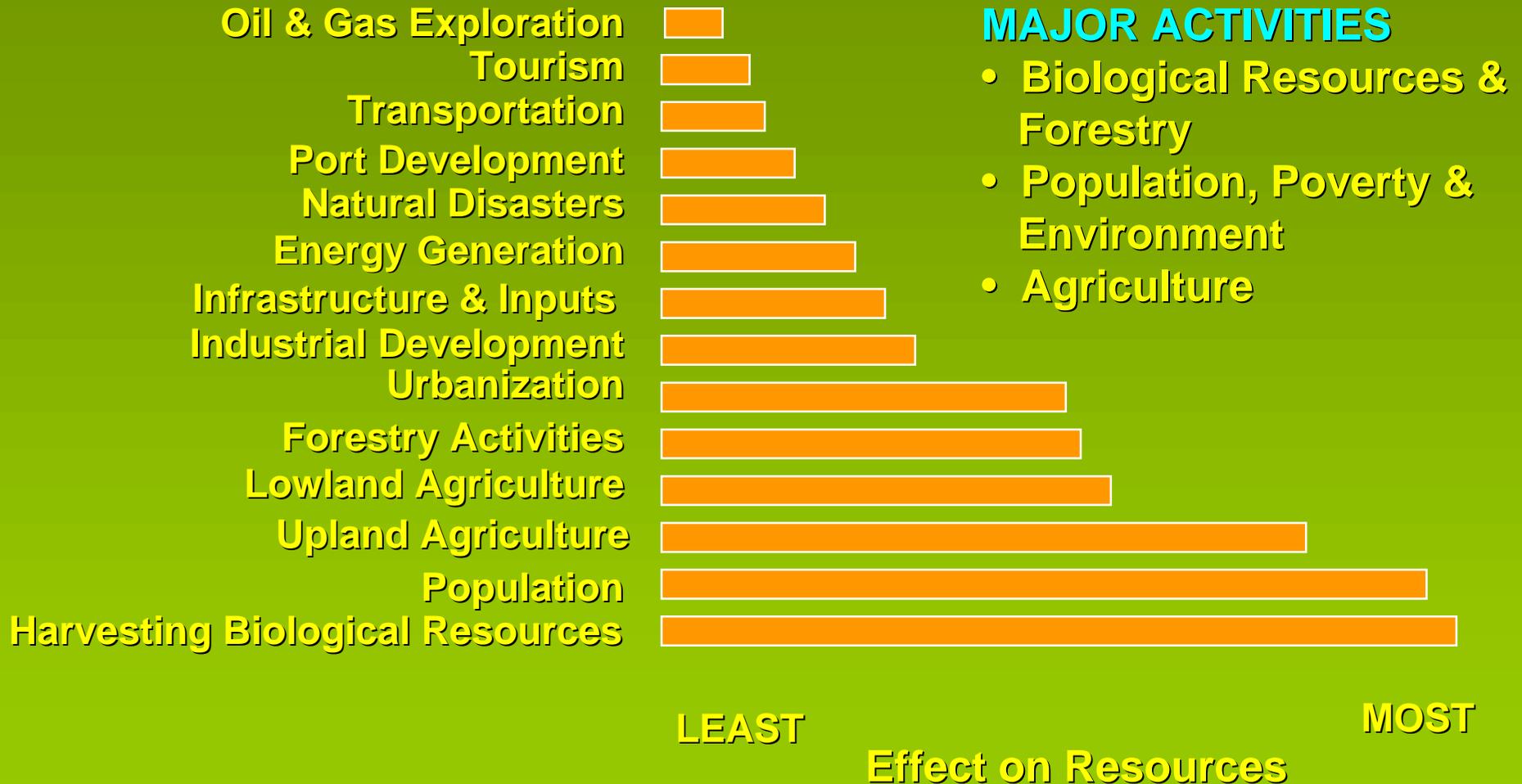
Urbanization and Industrialization (Cont'd)

- Environmental implications of expanding urbanization and industrialization in the MRB are profound; undesirable impacts observable in other industrialized countries include:
 - » degraded receiving water quality
 - » impacts to fisheries
 - » loss of aesthetic values
 - » reduced quality of life (e.g., air pollution)
 - » overwhelmed waste treatment facilities

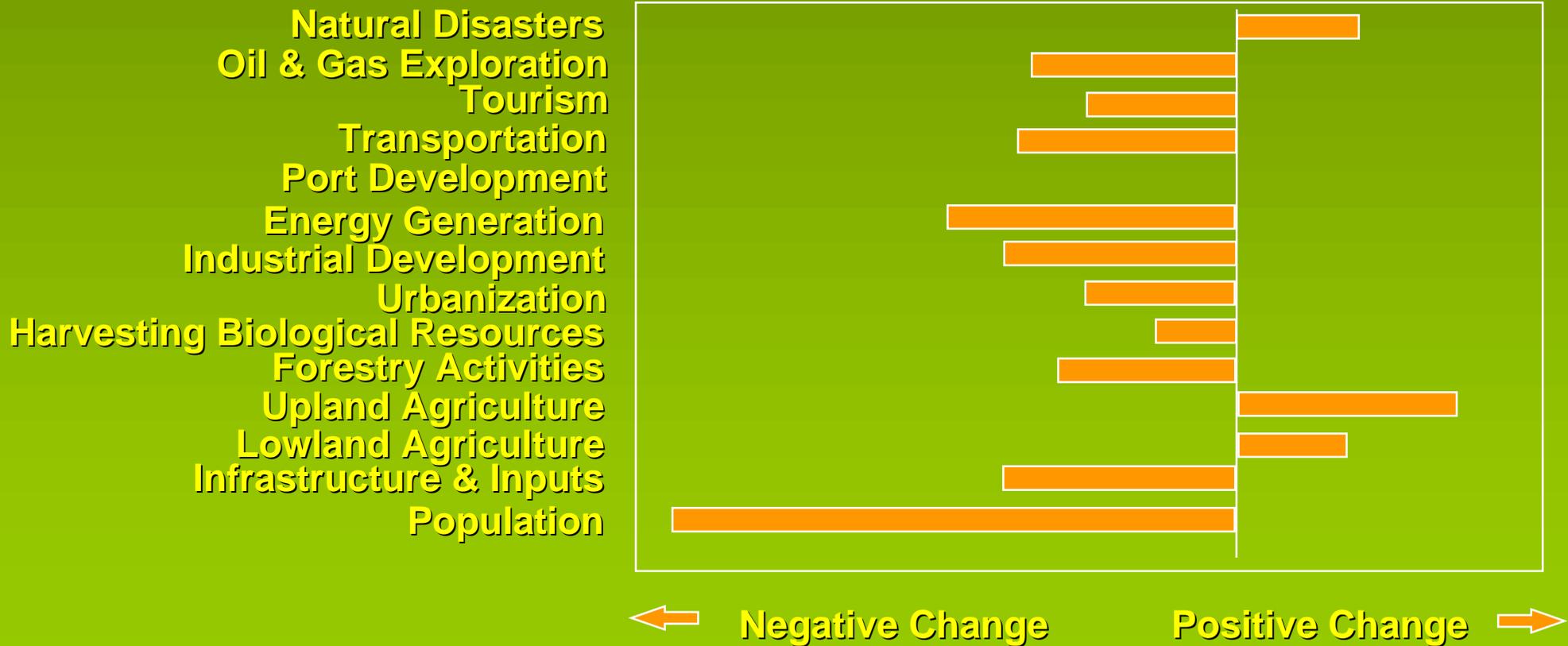
Current SoE Report for the MRB



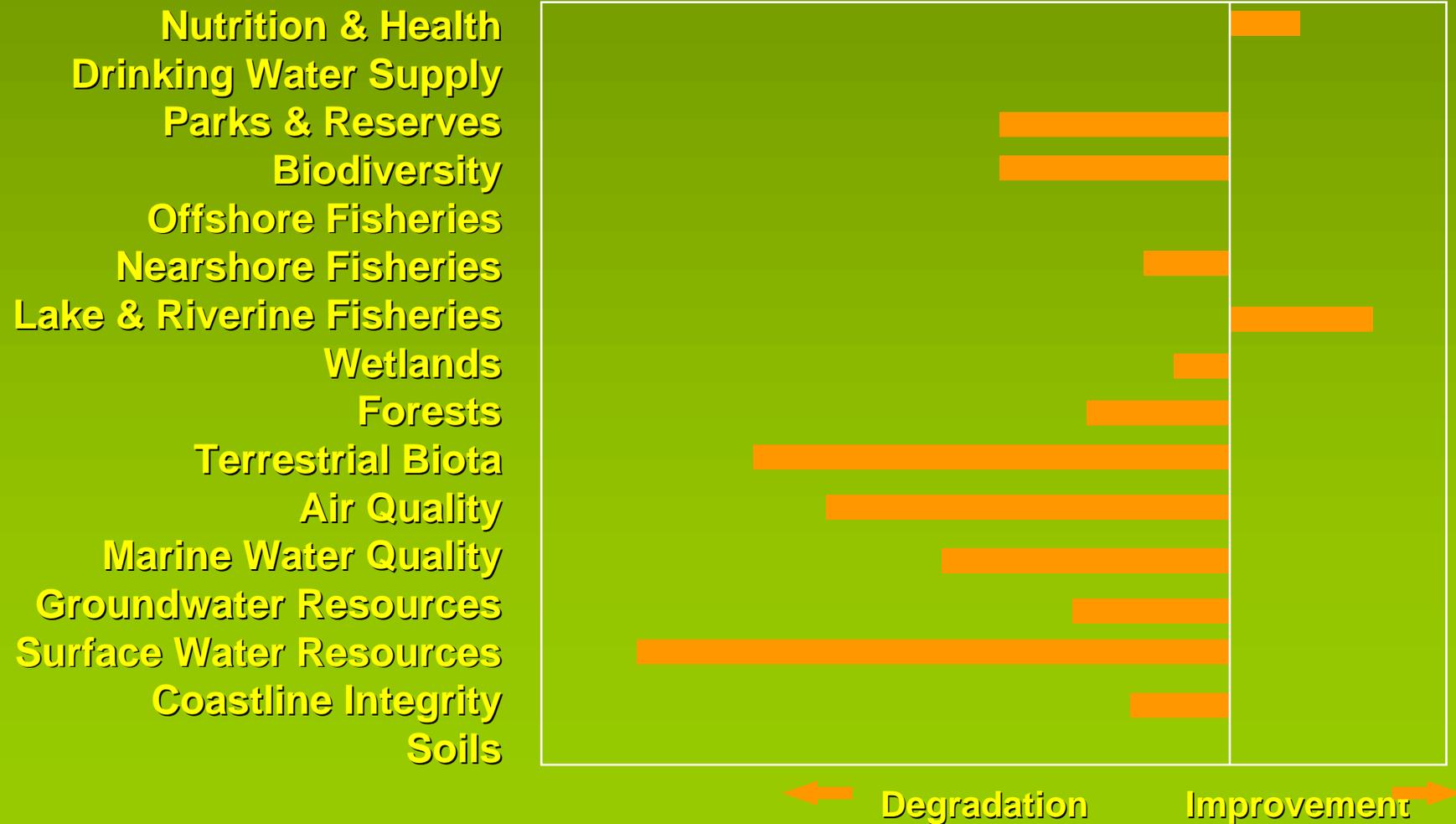
Human Related Impacts



10 Year Predicted Changes in Environmental Impacts



10 Year Predicted Changes in Environmental Resources



Expected Future Status Report



Concluding Thoughts

Important points to remember are:

- Ecosystems found in the MRB are among the richest and most varied in the world
- Environmental health is increasingly threatened by intensifying Basin development
- The Basin's ecological resources have been diagnosed as being in fair to poor condition
- Adoption of sound management practices will be necessary to mitigate development-related impacts and ensure the sustainability of ecological resources in the MRB