Focus Area 5 : Environment

Introduction

The constitution of Sri Lanka states that it is "The duty of every person in Sri Lanka to protect nature and conserve its riches". The national environment policy has been developed acknowledging this duty and provides directions to take steps to conserve and manage Sri Lanka's environment in all its aspects. The key concepts are Biodiversity, cleaner production, climate change, conservation, ecological process, ecosystems, environment pollution, environment indicators, environment integrity, environment accountability, evolutionary processes, invasive species, life cycle principle, living genetically modified organisms, polluter pays principle, precautionary principle, protection, sustainable development and caring for the environment. With all these concepts the outcomes to be achieved cover sectors in land, water, atmosphere and biological diversity.

Considering the need of sustainable use of environment for socio-economic benefits, several sub areas such as; Climate change, Natural disasters, biodiversity, waste management and environment sustainable technologies should be given proper attention.

Today it is a well-known fact that human activities cause climate changes of the globe and leads to environment and climate change related disasters. Research and projections indicate that Sri Lanka is highly vulnerable to effects of climate change and could be affected in different ways.

Raised temperatures and unpredictable monsoon rains are already affecting the country's food production and water resources. More frequent and intense droughts, as well as extreme weather events like flash floods, can disrupt public life and damage property and crop harvests. In the longer term, rising sea levels can impact the island's highly populated coastal areas, threatening human settlements, infrastructure and coastal/marine ecosystems.

In order to adapt to or to mitigate climate change there should be a proper understanding of the future scenarios of climate change in Sri Lanka. As such research need to be conducted to suitably downscale the global scale models and include specific features related to Sri Lanka in order to obtain a realistic and reliable climate change forecast for Sri Lanka. Further in order to achieve this task it will be necessary to develop human resources capacity in relevant fields. In order to contribute towards mitigation of climate change the focus should be directed to energy, transportation, industry, waste management, agriculture and livestock.

Sri Lanka has wide variety of biologically rich ecosystems from tropical rain forests to coral reef and is considered to be a biodiversity hotspot. Protecting it and sustainable use is essential as there have been reports that some of the species are threatened due to climate change or due to over exploitation for economic benefits. Removal of spices from the wild, competition between the invasive exotic species and indigenous species, lack of understanding of scientific management, pollution over visitation, under valuation of biodiversity are identified as some of the reasons for biodiversity depletion.

Waste management is an integral component of Environment management. Generation of waste has increased due to factors such as population growth, change of life style of people and technological developments. Research is needed to solve the problem of waste management with a long term solutions.

Air pollution, Sound and noise pollution are areas that have received low attention, but are growing to be major issues for Sri Lanka.

Change of natural environment due to economic development cannot be prevented. However, to minimize environment degradation due to development, energy efficient processes, development of green products has to be encouraged. With these actions it is expected to move towards sustainable development with minimal impact on natural environment.

Sub Areas, Issues and Relevant Interventions

Table 1: Sub Areas and Justifications

Sub Areas	Justifications
1) Climate change mitigation and adaptation i) Climate prediction (seasonal and long range) & future projections for Sri Lanka ii) Adaptations to climate changes iii) Mitigatory measures for climate changes	Climate prediction is needed for planning and decision making to minimize the vulnerability to climatic change and variability Need data as input for modeling and further refining of models Already available knowledge (globally) can be used adaptations to climate change by downscaling and incorporating local factors Mitigatory measures are needed to reduce vulnerability to the climate change
2) Environment and climate change related disasters - natural and manmade i) Assessment and monitoring of environment related disasters ii) Development of adaptation measures iii) Development of appropriate mitigatory measures	It is necessary to assess and monitor environment related disasters for saving life and natural resources and reduce burden on national economy

Sub Areas	Justifications
3) Bio diversity i) Threats and issues related to biodiversity ii) Mitigatory measures to control and minimize development induced impacts iii) Conservation of bio diversity and sustainable use iv) Rehabilitation of degraded ecosystem	It is necessary to understand threats and issues related to biodiversity in order to reduce their impacts. Biodiversity can be used in sustainable manner to reap economic benefits.
4) Pollution prevention and control i) Waste management ii) Prevention of air pollution, noise pollution and visual pollution iii) Prevent oil spills	It is necessary to minimize pollution and conserve the environment to assure healthy lives for the people. Pollution prevention measures are necessary to protect the environment
5) Environment sustainable technologies	To conserve environment, maximize the benefits and sustainable development of the country

Table 2: Issues/Problems, R&D Needs and Relevant Interventions

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
1) Climate change mitigation and adaptation *i) Climate prediction (seasonal and long range) & future projections for Sri Lanka*	I) Insufficiency of accurate seasonal and long range climate prediction	i) Promote accurate seasonal & long term climate prediction.	**Innovations** Develop methods for climate prediction
			ICT Development of a database for climate data
			Capacity building Train people for accurate climate prediction
ii) Adaptations to climate changes *iii) Mitigatory measures for Climate Change*	II) Lack of appropriate downscaling tools for local environment	i) Develop proper tools for local environment ii) Establishing permanent monitoring plots in each bio climatic zones iii) Development of communication tools for predictions by different social groups and creating awareness iv) Downscaling GCM Model	**ICT** a) Establish a database for constant monitoring of sea level rise, shoreline retreat, salinity, acidity and temperature. b) Create new models for monitoring/downscaling
			Pure and Applied Research a) Develop suitable communication tools for social groups b) Create awareness among society on climate changes
			Testing, standardization and accreditation Obtain accreditation for models developed

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	III) Insufficient appropriate adaptation methods	i) Carry out R&D to find out appropriate and sustainable adaptation measures	**Pure and Applied Research** Develop suitable adaptation measures for climate changes
			Popularization Create awareness among people/society on adaptation measures
	IV) Lack of mitigatory measures for climate change	i) Carry out a survey to find gaps in policy implementation regarding mitigation of climate change ii) Develop mitigatory measures for climate change	**Policy studies** Develop proper policy for climate change mitigation
			Popularization Create awareness among people/society on mitigation
2) Environment and climate change related disasters (natural and manmade}) *i) Assessment and monitoring of environment related disasters* *ii) Development of adaptation measures* *iii) Development of appropriate mitigatory measures*	I) Non-use of available information on disasters	i) Updating existing information and develop effective communication tools	**ICT** Development of a database
	II) Lack of appropriate technologies for adaptation measures, trained human resources, equipment, financial resources and awareness of all stakeholders	i) Minimize and control disasters such as flood, landslides, drought and other weather related disasters. ii) Develop appropriate technologies to reduce the impacts of natural and manmade disasters	**Pure and Applied Research** a) Research on disasters management b) Map disaster-prone areas.
			Policy Studies Develop policies for disaster management
			Innovation Develop technologies for disaster management

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Capacity Building Train people for disaster management
			Popularization Conduct awareness programs for all stakeholders including people prone to natural disasters
3) Biodiversity *i) Threats and issues related to biodiversity* *ii) Mitigatory measures to control and minimize development induced impacts* *iii) Conservation of bio diversity and sustainable use* *iv) Rehabilitation of degraded ecosystems*	I) Threats due to Climate change, land degradation, pollution, deforestation, fragmentation, invasive species and urbanization	i) Identify and asses development induced impacts on bio diversity and propose mitigatory measures. ii) Asses impact of climate change, pollution and urban development on biodiversity iii) Restore fragmented natural habitats iv) Carry out R&D on marine, coastal and terrestrial (including inland water) invasive species and developing methodologies for control v) Identification of impacts of climate change on migratory species vi) Carry out R&D on threatened species leading to development of recovery plans vi) Carry out R&D to measure the level of bio-accumulation and bio-magnification of toxic matter along the food chain vii) Carry out R&D for vulnerable species leading to extinction and identify causes and methods for restoration.	**Pure and Applied Research** a) Research on adverse effects on biodiversity due to climate change, pollution etc. b) Develop methods of landscaping to enhance urban bio diversity c) Measure the exploitation level of bio diversity d) Measure visitor and ecological carrying capacity of protected areas
			ICT Development of a computerized model to assess impacts of climate change on bio diversity
			Popularization Conduct awareness programs on threats to biodiversity due to pollution, deforestation and invasive species

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	II) Inadequate environmental concerns of development interventions	i) Revisit existing policies and develop required new regulations ii) Identify and assess development induced impacts on biodiversity iii) Develop mitigatory measures to reduce impact of development including, alternative technologies	**Policy Studies** a) Development of proper policies to consider environment impacts in development projects. b) Carry out survey to identify deficiencies in implementation of prevalent regulatory measures
			Pure and Applied Research a) Research on environmental impacts of development projects. b) Carry out research to provide evidence based recommendations to take effective decisions on development projects (e.g. impact of wind power plants on birds etc.)
			Innovation Develop mitigatory measures to reduce impact of development on biodiversity
	III) Lack of awareness on social issues related to threats on bio diversity	i) Conduct survey to assess social issues related to biodiversity and extent of public awareness on threats ii) Develop effective communication tools to create awareness	**Pure and Applied Research** Surveys on social issues related to threats on biodiversity
			Popularization Conduct awareness program for public

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	IV) Non-compliance and inadequate provisions in regulatory environment	i) Minimize human-wildlife conflict such as elephants, monkeys etc. ii) Develop monitoring mechanism for effective compliances	**Policy Studies** a) Create regulations to minimize human wild life conflict b) Investigate level of compliance by development projects
	V) Lack of awareness and negative attitudes of decision makers and general public	i) Develop monitoring mechanism and effective communication tools	**Pure and Applied Research** Conduct a survey on awareness and attitudes related to biodiversity
			Popularization Conduct awareness programs
	VI) Lack of awareness on potential benefits of bio diversity , scale of usage, sustainability	i) Inventorying of bio diversity of Sri Lanka ii) Carry out R&D to harness the potential benefits of bio diversity for sustainable economic uses iii) Promote research on eco-system services (Changes of the service level, quality, quantity, and impacts on livelihoods) iv) Update national conservation review v) R&D for ex-situ propagation and cultivation of commercially important flora and fauna vi) Identify plant species that can be used for value added industry	**Pure and Applied Research** a) Sustainable use of biodiversity and ecosystem services b) Bio indicators of pollution c) Species that can be used for eco system restoration d) Threatened species e) The level of bio accumulation of toxic matters f) Agro bio diversity and medicinal plants g) Commercial importance of flora and fauna h) Identify problems associated with degrading ecosystems

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Popularization a) Conduct awareness programs on sustainable use and benefits of biodiversity, invasive species and medicinal plants. b) Awareness campaigns for relevant authorities and industries
			Policy Studies a) Develop policies for sustainable use of bio diversity b) Develop benefit sharing mechanisms c) Develop policy for conservation and sustainable use of medicinal plants
			Indigenous knowledge & Intellectual Property Rights a) Promote Indigenous knowledge based biodiversity conservation and management b) Research on Indigenous knowledge based water conservation & tank cascade management
	vii) Degrading Eco-systems due to un-planned development processes and climate change	i) Identify problems associated with degrading eco-systems	**Pure and Applied Research** Conduct a survey on causes of degrading eco systems

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Policy Studies Formulate proper policies / regulations to protect eco-systems from development processes
4) Pollution prevention and control	I) Unplanned urbanization and industrialization	i) Investigation and revisiting of existing policies	**Pure and Applied Research** Research on pollution due to urbanization and industrialization
			Policy Studies Develop strategies to implement existing policies effectively
	II) Unavailability of proper disposal methods and sites for solid waste	i) Create awareness on solid waste management ii) Develop resource recovering technologies for non-biodegradable waste	**Pure and Applied Research** a) Generating national solid waste profile b) Research on quality improvement of compost c) Research on non-biodegradable waste
			Innovation a) Develop technologies for utilization of bio degradable waste b) Technologies for biogas generation c) Technologies for resource recovery for non-bio degradable waste
			Testing, Standardization & Accreditation Obtain quality certification for compost fertilizer

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Popularization Create awareness on proper solid waste disposal, compost preparation, utilization of bio degradable waste
	III) Health issues, soil contamination, coastal pollution due to sewage sludge	i) Development of environment friendly swage/ sludge/seepage management technologies	**Innovation** Develop environment friendly sewage/sludge management techniques
	IV) Inadequate capacity and facilities to manage clinical waste	i) Identify clinical waste management practices used by hospitals and diagnostic laboratories ii) Identify different cost effective technologies for specific clinical waste (e.g. cyto-toxic drug waste) iii) Monitoring of laboratory chemical waste disposal	**Policy Studies** Develop policies for clinical waste management
			Pure and Applied Research Island wide survey to identify clinical waste management practices used by hospitals and diagnostic laboratories
			Innovation Development of cost effective technologies for clinical waste management
			Testing, Standardization & Accreditation Accreditation of diagnostic laboratories
			Popularization Awareness campaigns for relevant stakeholders on clinical waste management

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	V) Sedimentation eutrophication in inland tanks/ water bodies due to soil erosion, heavy rain & flash floods	i) Develop innovative technologies to prevent soil erosion and to minimize sedimentations in water tanks	**Pure and Applied Research** Research to identify coastal plant species with special reference to economic values that can be used to minimize sedimentation (e.g. *Pandanus)*
			Innovation Develop technologies to prevent sedimentation
	VI) Lack of effective and efficient methodologies for effluent/emission/industry /domestic waste management	i) Investigate the feasibility of developing common waste treatment facilities ii) Develop a model to predict water pollution qualitatively and quantitatively that occur from new industrial plants	**Capacity Building** Training relevant people for waste treatment
			ICT Develop a Model to detect water pollution
			Pure and Applied Research a) Assess assimilation capacity of fertilizer or waste in the environment b) Assess industrial waste load in water bodies
			Innovation a) Develop low cost waste treatment methods for industries b) Develop common waste treatment facilities managed by 'Vidatha' centers c) Development of low cost ground water treatment methods

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	VII) Inadequate technologies, facilities, trained HR to manage e-waste and nuclear waste	i) Low cost waste management methods for e-waste and nuclear waste	**Innovations** a) Development of low cost waste treatment methods b) Development of recycling methodologies c) Develop technologies for hazardous waste management
			Policy Studies a) Develop Policies to manage hazardous waste b) Conduct survey to identify international conventions on nuclear waste
			Capacity Building Train people for hazardous waste management
	VIII) Lack of awareness and attitudinal constraints on e-waste and nuclear waste	i) Create awareness ii) Identify international conventions on nuclear waste management and policies that need to be implemented in Sri Lanka	**Popularization** a) Create awareness on hazardous waste
			Capacity Building Conducting awareness programs for e-waste collectors on hazardous effects of the e-waste and giving them proper job training
			Pure and Applied Research Identification of sources and materials that come under nuclear waste category

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	IX) Air pollution due to urbanization and industrialization	i) Monitoring of air pollution levels in large cities and areas near industrial zones ii) Assess and find methods to mitigate trans boundary pollutant issues	**Policy Studies** a) Develop Policies to control air and noise pollution b) Study international treats to produce sustainable policy for Sri Lanka c) Develop regulations on air and noise pollution for industrial zones
			Pure and Applied Research a) Research on effects of air pollution and noise pollution on human health b) Survey on pollution levels c) Research on trans boundary pollution d) Research on low cost emission treatment methods
			Popularization Create awareness on air pollution and noise pollution
			ICT Develop models to measure air pollution and noise pollution
			Testing, Standardization & Accreditation Accredit emission treatment methods

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	X) Sound and noise pollution due to urbanization and industrialization	i) Conducting R&D on community noise, and related health problems	**Pure and Applied Research** Research on effects of noise on human health
			Popularization Create awareness on effects of noise pollution and safety measures
	XI) Visual pollution that occurs due to un planned urbanization and inadequate regulations	i) Reduce the visual pollution induced by urbanization	**Pure and Applied Research** a) Research on health issues related to visual pollution b) Behavioral changes of plants and animal due to visual pollution
			Policy Studies Develop appropriate policies and regulations to minimize visual pollution in urban areas
			Popularization Create awareness on visual pollution
	XII) Lack of technologies and capacity to deal with large scale oil spills	i) R&D for efficient removal of spills and develop scientific model for assessing the damage	**Policy Studies** Activate and adopt international regulations related to oil spills
			Innovation Develop technologies to remove oil spills
			ICT Develop models to assess damage of oil spills

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Capacity Building Train people to remove oil spills
6) Environment sustainable technologies	I) Lack of awareness, resources, attitudes and regulation	i) Development of green technologies	**Innovation** Develop environment sustainable technologies/products
			Popularization Create awareness on environment sustainable technologies
			Capacity Building Train people on environment sustainable technologies
			Testing, Standardization & Accreditation Accredit the process of development of environmental sustainable products

***Table 3: Interventions and Key Performance Indicators**

Sub Areas and Issues/Problems	Interventions/Activities									
	Policy Studies	**Pure and Applied Research**	**Innovation**	**Information and Communication Technologies**	**Nanotechnology**	**Biotechnology**	**Indigenous knowledge & Intellectual Property Rights(IPR)**	**Testing, Standardization & Accreditation**	**Capacity Building**	**Popularization**
1) Climate change mitigation and adaptation										
i) Insufficiency of accurate seasonal and long range climate prediction		√	√	√					√	√
Time Frame(TF)	Medium									
KPIs No. of new technologies developed Development of database Awareness programmes NO. of Officers trained										
Lead Institute (LI)		Universities Research institutes								

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