Institutional Review

Assessment of the Natural Resources Management Centre (NRMC)

Report Prepared for the National Science and Technology Commission Sri Lanka

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December 2017

Institutional Review of the Natural Resources Management Centre (NRMC)

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Abbreviations

AFACI	Asian Food & Agriculture Cooperation Initiative
ALMSF	CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
CCAFS	Climate Change, Agriculture and Food Security
CEA	Central Environmental Authority
CKDu	Chronic Kidney Disease of unknown aetiology
DLWA	Technology dissemination for land and water resource development in Agriculture
DOA	Department of Agriculture
EIA	Environmental Impact Assessment
FLI	Farm Level Implementation
FPNP	Food Production National Program
GIS	Geographic Information System
GOSL	Government of Sri Lanka
HARTI	Hector Kobbekaduwa Agrarian Training and Research Institute
ISCA	Implementation of Soil Conservation Act
ISTI	Agriculture In-Service Training Institute
IWMI	International Water Management Institute
KHG	Kandian Home Gardens
LWMRC	Land and Water Management Research Centre
LUPPD	Land Use Policy Planning Department
M&E	Monitoring and Evaluation
MASL	Mahaweli Authority of Sri Lanka
MIS	Management Information System
NARP	National Agriculture Research Program
NASTEC	National Science and Technology Commission
NEM	North East Monsoon
NRMC	Natural Resource Management Centre
NSF	National Science Foundation
NFPP	National Food Production Programme
NFS	Neglected Fruit Species
OFC	Other Field Crops
PDA	Provincial Departments of Agriculture
R&D	Research and Development
RDA	Road Development Authority
RNRM	Research on Natural Resource Management
SCA	Soil Conservation Act
SAR	Self-Assessment Report
S&T	Science and Technology
SLLDRC	Sri Lanka Land Reclamation & Development Corporation
SLM	Sustainable Land Management
SMO	Subject Matter Officers
SWM	South West Monsoon
SWOT	Strengths, Weaknesses, Opportunities, and Threats Analysis
TLWA	Technical assistance for Land and Water resource development in Agriculture

Acknowledgement

The Review Panel appreciates the National Science and Technology Commission for the trust placed on them to perform this review and also for the guidance provided to carry out the review in comply with the Review Manual Guidelines.

NASTEC Director Dr. Muditha Liayanagedera and Senior Scientist Dr. Kalpa W. Samarakoon, who coordinated this review in numerous ways enabling timely completion of the work, are gratefully acknowledged.

The Director, senior scientists and the staff of the Natural Resource Management Centre management showed a great interest on this review and cooperated fully in carrying out this review. We deeply appreciate their support and input to successfully complete the reviewing process.

This review included two sessions of successful stakeholder meetings. Valuable inputs were received from representatives of other government institutes, private sector, provincial departments of education and agriculture, farmers and entrepreneurs, which were very important in conducting a comprehensive review.

Executive Summary

The Natural Resources Management Centre (NRMC), is established in 1974, as one of the six centres of the Department of Agriculture within the Ministry of Agriculture. The institution is headed by a Director. There are five main divisions, namely, Soil Conservation, Land and Water resources Management, Agro-Climatology and Climate Change, Geo-informatics and Land Use Planning and Knowledge Management. The staff strength at present is 63 with 41 vacancies. The fund allocated from treasury in 2016 was Rs. 77.66 million and was complemented with foreign funds of Rs. 2.0 million.

A five member team appointed by NASTEC has carried out a review from 25th September 2017 to 10th November 2017 according to the guidelines provided in the Review Manual. The review team visited the NRMC, held discussions with the management team, researchers, technical and other support staff and also inspected the facilities available. In order to validate the performance and output of the NRMC, the review team organized two stakeholder meetings at Colombo and Peradeniya. Having completed the stakeholder meetings and perusing addition documents, the review team met at NASTEC to formulate the findings.

The NRMC with a responsibility to implement Soil Conservation Act and providing information on the onset of cultivation to farmers, in addition to research, training and providing technical support to many stakeholders, has contributed to the national development in spite of a severe dearth of human resources. The present work load had been undertaken primarily by 01 Deputy Director and 06 Senior Researchers though the approved carder is 06 and 26 respectively for the said posts. There is a danger with respect to the unhindered NRMC services in each of these nationally important areas of activity because of the impending retirement of trained, highly qualified staff expected to take place in the near future. Hence the review team strongly recommend urgent actions to address this issue with due consideration.

Implementation of Soil Conservation Act is important in formal approval of development project through the CEA. If the project is located within the Conservation Area gazetted by the Minister of Agriculture, a clearance from the NRMC is required before granting the final approval by the CEA. On average, 300 such approvals are granted by the CEA with the support of the NRMC. The team recognised the need to expand this service with the on-going increase of development projects and the expansion of the conservation areas.

Maintenance of agro-meteorological stations and providing data to meteorology department and other stakeholders is also a regular activity of NRMC. This input has become more important in the recent past in view of climate change and associated high rainfall variability. Changing weather also has a severe impact on food production. With the DOA being a responsible agency at national level the prediction of harvest by NRMC research becomes very important to assure food security.

Through a series of consultations with the staff of NRMC and its stakeholders, an expanded mandate of NRMC to cover the entire country with an amended Soil Conservation Act was recognised. This is mainly because soil erosion is not limited to the hill country. Accordingly, it is recommended to locate at least one officer attached to NRMC at each province. Having considered the recruitment of personnel for all existing cadre positions while addressing new immerging issues, a new organizational

arrangement has been proposed by the NRMC, which is in line with the findings and recommendations of the review team who strongly endorses the proposal.

Considering the above, it is vital to take action based on the findings of this review of NRMC. It is important to ensure that the NRMC has sufficient strength in terms of financial, human and legal resources to provide services according to the objectives stipulated since its establishment in 1974. Details of findings and recommendations under 8 subheadings, as indicated in the review guidelines and discussed in the report needs to be addressed to make NRMC as an effective and efficient organization.

The recommended activities should commence with the development of a corporate plan/strategic plan with a mandate, vision, mission, goals, strategies and activities having a clear time frame. As indicated previously wider stakeholder participation needs to be ensured for the success of these activities. It is mandatory that the DOA and GOSL fully endorse this reform process with required administrative support, legal provisions and financial allocations.

Assessment of the Natural Resources Management Centre (NRMC)

Review Report

1. Introduction

The Natural Resources Management Centre (NRMC) was established in 1974, as the Land and Water Management Research Centre (LWMRC) in the Department of Agriculture (DOA) and played a vital role in soil and water management and its outputs were well utilized in the country's agricultural development activities during 70s. Later in 1974, the activities and the responsibilities were broadened with the amalgamation of the Soil Conservation Division of the DOA. In 1994, with the re-structuring of the Department of Agriculture, the LWMRC was renamed as Natural Resources Management Centre. Since then, the NRMC had not only involved in research on natural resource management, but also had been entrusted the responsibility of technology dissemination and providing technical assistance for land and water resource development in agriculture together with the implementation of Soil Conservation Act (SCA). Landuse changes, agro-climate and climate change are exerting additional pressure on limited resources by rapid degradation of natural resources thereby affecting productivity. Therefore assessing the present situation with modern techniques to develop and disseminate new technologies in order to address the prevailing issues is of utmost importance for national food security. Development of technologies targeting judicial utilization of natural resources while conserving particularly land and water resources is a vital task. Working in line with the above, the NRMC conducts research and development activities covering identified disciplines through five divisions.

1.1. The Vision

The Vision of NRMC is "National prosperity through sustainable land and water resources management".

1.2. The Mission

The Mission of NRMC is "to optimize the use of land and water resources on scientific basis for improving agricultural productivity in a sustainable manner for livelihood upliftment of the people of Sri Lanka while protecting the environment".

2. Organisational Targets

2.1. Goal

Well-maintained natural resources (soil, water and environment) for better agricultural production.

2.2. Objectives

- Technological development in soil conservation and its effective dissemination.
- Conservation of soil resources through legal means (Implementation of soil conservation act)
- Harness the potential of agro-climate for enhancing agricultural production while reducing the vulnerability to climate change.
- Enhancing water use efficiency and water productivity in both rainfed and irrigated systems.
- Minimize adverse impacts on soil productivity and water quality due to unhealthy management.
- Ensure efficient and systematic utilization of land and water resources for agriculture through application of Information technology, geo-information and remote sensing technology.
- Ensure the sustainability of ecosystems and their services.
- Strengthen knowledge on sustainable use of natural resources by sharing resources and expertise of local and international agencies through collaborative research programs.
- Enhance farmer livelihood by updating farmers' knowledge and capacity to utilize natural resources through effective and farmer participatory technology dissemination approaches.

2.3. The Governing Institute and the Ministry

The NRMC is one of the six centres of the DOA within the Ministry of Agriculture and, thus reports directly to the Director General of Agriculture. The treasury funds are allocated to the NRMC through the DOA. In addition, NRMC also receives funds from foreign sources. The treasury allocation of Rs. 30.99 million in 2014 has substantially increased to Rs. 77.66 million during 2016 whilst allocation of Rs. 5.49 million from foreign sources in 2014 has decreased to Rs. 2.0 million in 2016.

2.4. Organizational Structure and staff

The present organization structure of the NRMC is given in Figure 1. The institution is headed by a Director. There are five main divisions, namely, Soil Conservation, Land and Water resources Management, Agro-Climatology and Climate Change, Geo-informatics and Land Use Planning and Knowledge Management. There is an Additional Director and a Deputy Director to guide all these five divisions. The staff strength at present is 63 with 41 vacancies (Table 1). Majority of these vacancies are in the category of science and technology. The organisational structure as at present, has noteworthy features. All principle scientists are under the Director and there are no divisions allocated for principal scientists. However, the principle scientists provide leadership to respective divisions in technical matters. It is also been reported that the principle scientists are expected to work according to the directions of the Deputy Director of Research of the DOA. This indicates that there is an ambiguity with regard to the organizational structure and responsibilities of the senior research staff of the NRMC.

Table 1: Present Staff Strength of NRMC

Number of Employees/ Category	2014			2015			2016		
	Cadre	No Filled	Vacancies	Cadre	No Filled	Vacancies	Cadre	No Filled	Vacancies
S&T personnel	41	13	28	41	12	29	41	12	29
Administrative staff	08	06	2	08	04	4	08	05	3
Technical staff	32	24	8	32	27	5	32	28	4
Supporting staff	23	16	7	23	20	3	23	18	5
Total	104	59	45	104	63	41	104	63	41

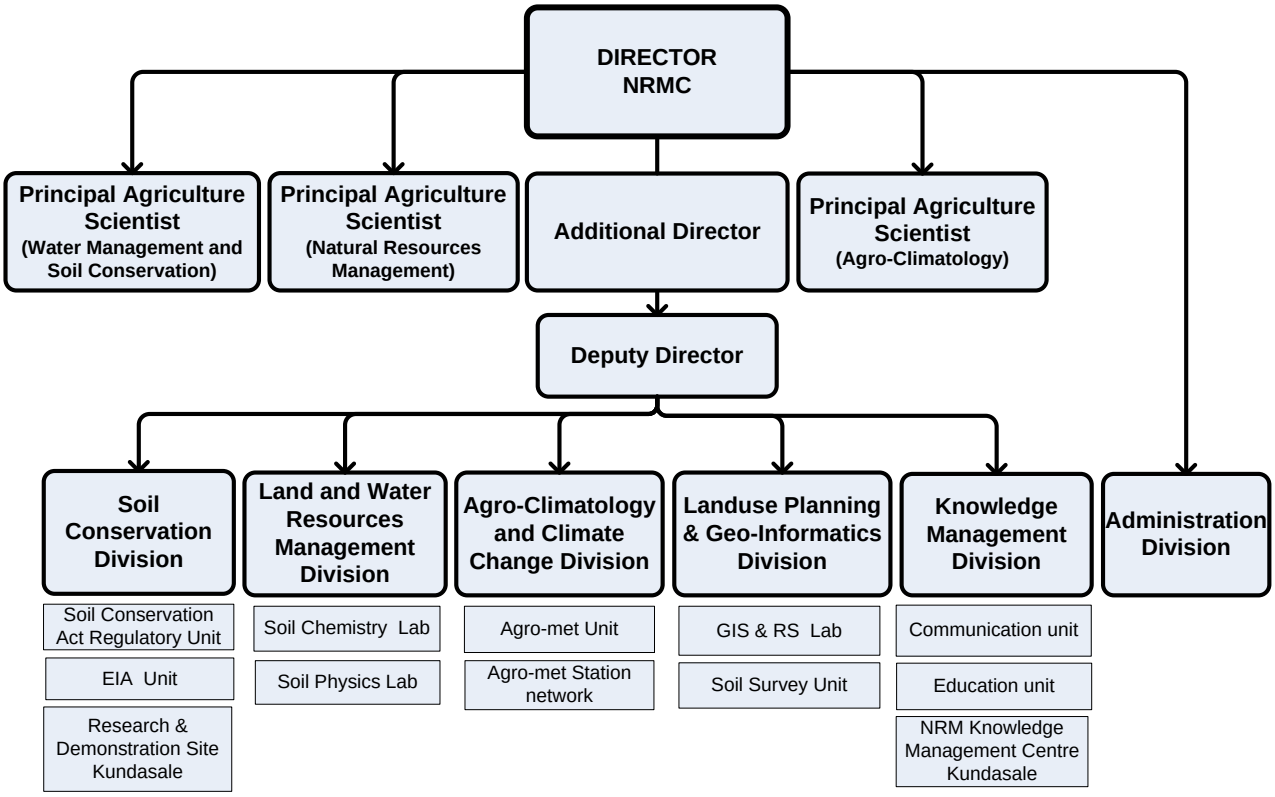

Figure 1: Organogram of the NRMC

3. Procedure Adopted for Performance Review

3.1. The Team

The NASTEC in consultation with the NRMC has appointed the following members for the review.

Prof. E.R.N.Gunawardena	Senior Professor, Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya
Eng. W.B.Palugaswewa	Director of Irrigation (Water Management and Training), Department of Irrigation, Colombo
Mr. K.H.M.S.Premalal	Director General, Department of Metrology, Colombo
Dr. W.A.U.Vitharana	Senior Lecturer, Department of Soil Science, Faculty of Agriculture, University of Peradeniya
Eng. Prof. N.T.S.Wijesekera	Senior Professor, Department of Civil Engineering, Faculty of Engineering, University of Moratuwa

3.2. Process

The team met at the NASTEC on 25th September 2017 at 3.00 pm and discussed the procedure to be followed during the review. Review team was provided with the Self-Assessment Report (SAR) of the NRMC. The team visited the NRMC on 3rd and 4th October 2017 and held discussions with the management team, researchers, technical and other support staff. In addition, the review team also inspected the facilities available at the Centre. The management and part of the output assessment was completed during the visit.

In order to validate the performance and output of the NRMC, the review team decided to organize two stakeholder meetings at Colombo and Peradeniya. This decision was based on the wider stakeholder community served by the NRMC and to allocate adequate time for discussion with the participants. Accordingly, the 1st Stakeholder meeting was held at the Hector Kobbekaduwa Agrarian Training and Research Institute (HARTI) on 2nd November 2017 and the second stakeholder meeting was held on 10th November 2017 at the In-Service Training Institute of the DOA at Gannoruwa. A questionnaire was circulated among the stakeholders to gather additional information. The outcome of the stakeholder meetings are given in Annex 7.1.

Having completed the stakeholder meetings and perusing addition documents, the review team met at NASTEC to formulate the findings of the review exercise. The draft report, compiled by the team has been circulated among the members for additional comments prior to handing over to NASTEC in order to obtain comments from NRMC.

4. Commentary Sections on Management Assessment and Output Assessment

4.1. Management Assessment

The team critically evaluated the information collected during the review and ranked the associated components through consensus building discussions. Tabulation of the assessments and remarks are in Annex 7.2.

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4.1.1. Assessment of Institutional Response to External and Internal Environment in Planning Organizational Strategy

The review team finds that the mandate and the current organizational strategy of the NRMC is not properly supported with required Acts, Ordinances etc., though it has articulated its mandate, vision, mission and objectives. The Soil Conservation Act of 1951 as amended by Act no 24 of 1996 has given the responsibility to implement the SCA to the Director General of Agriculture who in turn delegated this responsibility to the NRMC. This is considered as the only legal provision that empowers the NRMC to undertake activities related to soil and water conservation in agricultural lands. Being identified as the only institution vested with the responsibility to implement the SCA, it has become necessary for the NRMC to grant clearance to development projects (National Environment Act No 47 of 1980 as amended by Act No 56 of 1988 included any areas declared under SCA to go through EIA Process).

The review team finds that the NRMC is responsive to changes in government policies and strategies and accordingly prioritizes its activities to fulfil such requirements. This, to a certain extent, affects the planned activities of the institution. There is no corporate plan/strategic plan available though, the activities of the NRMC are listed under the Corporate Plan of the DOA. NRMC as an institution within the DOA, is guided by the Directorate of the DOA. However, there is inadequate evidence to show that the Directorate is involved in strategic planning of the NRMC. Funding is not considered as a constraint as at present (Table 2) in view of the dearth of human resources. This is indicated by partial utilization of annual funding (55 – 71.5%) Only an annual informal institutional review is carried out for review and update of the activities of the NRMC. In general, there is very little evidence to show that the external stakeholders are involved in any strategic planning of the NRMC.

4.1.2. Planning S&T programs and setting priorities

There is an ad-hoc planning of S&T programs and absence of prioritization scheme when national development goals are considered. A weak institutional stakeholder consultation is observed in programme planning. There is inadequate documentary evidence on Program planning and priority setting with staff participation. Funding is not considered as a constraint and all available equipment and resources are considered in planning programmes. As in the case of strategic planning, only the internal stakeholders are involved with the absence of external consultation when planning the programmes. There is no framework to consider the socio economic and external service provision aspects in programme planning while no documented procedures are in place to ensure effectiveness and efficiency of institutional procedures in approving new science and technology programmes.

4.1.3. Planning S&T / R&D Projects

There is no documentation on procedures to show that the staff is provided with guidance for research project planning. Previous research results are captured through personal data bases when planning projects and only meeting records are available for preparation, review and approval of projects. There is inadequate identification of multidisciplinary approaches in project planning. Most of the external projects are undertaken with foreign collaboration whilst there is no mechanism to partner with the private sector and universities. There is evidence that basic research had been undertaken by the NRMC. Main mandate of the institution is soil conservation. All projects/programmes are aligned towards the mandate. Presently the organisation maintains a climate database. There is an insufficiency in the requisite number of licenced software. Thus, this requirement need to be considered in project planning.

Table 2: Financial disbursement from 2014 to 2016

Votes/Activities	2014		2015		2016	
	Allocated	Spent	Allocated	Spent	Allocated	Spent
Capital (treasury funds)	10,147,160	4,556,576	12,371,906	11,100,000	10,400,000	9,722,318
Recurrent (treasury funds)	3,985,672	3,195,092	3,521,240	3,100,000	2,760,489	2,597,447
Soil Conservation Act	14,000,000	13,222,390	15,000,000	11,835,827	15,000,000	11,835,827
NARP	2,857,284	2,091,505	1,350,000	815,643	1,500,000	815,643
CCAFS	2,556,721	1,168,230	16,000,000	324,557		
AFACI - ALMSF 1-7	1,166,844	1,094,982	1,000,000	399,388	1,000,000	399,388
AFACI - AMIS - 8	1,771,455	748,282	1,000,000	46,056	1,000,000	46,056
NFPP					48,000,000	36,800,000
Total	36,485,136	26,077,058	50,243,146	27,621,471	50,243,146	27,621,471
Annual utilization		71.5 %		55.0%		55.0%

NARP (National Agriculture Research Program)
CCAFS (climate change impact assessment for Sri Lanka)
NFPP (National Food Production Programme)
AFACI (Asian Food & Agriculture Cooperation Initiative)
ALMSF (CGIAR Research Program on Climate Change, Agriculture and Food Security)

4.1.4. Project management and maintenance of quality

There is no prior planning for resource allocation and the practice is to allocate resource on demand. However, there had been no reported problems in following that procedure except for the underutilization of funds. Instruments, equipment and infrastructure facilities are satisfactory for selected scope. Once the mandate is clearly identified, it is necessary to document and practice administrative procedure to align with the mandated activities. Formal monitoring process to direct projects towards achievement of objectives is not in place. Therefore, prescheduled monitoring process should be implemented to assess the physical and financial progress of projects. The review visit revealed inadequate support staff as reported by both senior and technical staff. The Internet facilities are available with limited access.

4.1.5. Human Resource Management

The available human resources have been identified as a major constraint at the NRMC as shown in Table 3. Rearranging space, logistics, equipment and procedures in promoting a good working environment has helped to maintain high staff morale. The vacancies of Science and Technology persons are more than twice the recruited staff. Only 01 Deputy Director and 6 Research Staff (Assistant Director Agriculture in Research) are available whilst the approved cadre is 06 and 25, respectively. The problem of inadequacy of staff is beyond the control of the institution. The effectiveness of the selection procedures and the schemes of recruitment are incompatible with most undertaken programs. There is no training need assessment and pre-plan for capacity building. There is no central database on staff information and no staff performance appraisals other than annual increment recommendations. Rewards and incentive schemes in motivating the staff is not in existence. No significant issues were highlighted in staff turnover, absenteeism and work interruptions.

4.1.6. Management of organizational assets

The institution is unable to manage its organizational assets due to lack of clear mandate, strategic plan and inadequacy of staff. Presently available infrastructure is well maintained. There is only one new vehicle available and others are fairly old, thus hindering the field work. Most of the equipment had been procured recently and are in good working order. In general, the allocated funds are underutilized (Table 2). Though, the services provided by the institution had not been quantified and valued, the review team is of the opinion that the investment made on NRMC is fully justified.

4.1.7. Coordinating and integrating the internal functions/ units/activities

There are informal, internal communication and coordination mechanisms in place. There is no evidence to indicate that overall direction and coordination is provided by a central planning committee. Clearly defined functions are assigned only for several divisions. The Terms of Reference or work schedule of staff are not available. It was also noted that the individual feedback procedures other than annual report is in place.

4.1.8. Partnership in managing information dissemination

The NRMC disseminates information primarily through printed materials as presented in the Table 3. The team noted that the data used in the printed dissemination material lacks scientific publications as references to fulfil the authentication requirements. Occasionally, the NRMC carries out radio and TV programmes (e.g. A TV program for National Television Channel (Rupavahini) on World Soil Day on "Soil: Foundation for Family Farming"; A TV program for Education Service of Rupavahini on "Soil Erosion and Conservation"). However, the NRMC lacks a dissemination plan for policy makers, though the information is channelled through formal, hierarchical system. There is evidence of linkages, together with sharing and dissemination of information among key partners. The institutional procedures for technology transfer are available to some extent. However, there is no evidence of feedback mechanisms.

Table 3: Types of publication of NRMC

Type of publications	Number of publications in each year		
	2014	2015	2016
Technical reports	10	21	17
Consultancy reports	14	22	16
Advisory materials/ Information leaflets	04	04	18
Newsletters	11	16	04
Other publications Training manuals, Scientific databases, Books, etc.	14	11	25

4.1.9. Monitoring, evaluation and reporting procedures

There is no evidence that the institution monitors and evaluates its own activities periodically. The institution also does not have an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and results). The S&T results and other outputs, are adequately reported internally through project reports, research papers, maps etc. In this connection there should be internal mechanism to provide funds to encourage scientists to publish research papers in International Journal, as NRMC activities are research oriented. There is no established process to receive external stakeholders' contribution to the M&E process in the institution. There is no structured self-evaluation process in place to use results of M&E for project/ research planning and decision-making.

4.2. Overview of the Institution's performance and contribution to national development

Based on the SAR, the mandate of the NRMC was categorized into, a) implement Soil Conservation Act, b) maintain 28 agro-met stations island wide and provide quality controlled data to stakeholders c) research on natural resource management, d) technology dissemination for land and water resource development in agriculture and, 5) providing technical assistance for land and water resource development in agriculture by the review team. The major activities conducted from 2014 to 2016, as shown in Table 4, indicate that the output on research, technical assistance for land and water resources development and implementation of SCA and maintenance of agro-met stations are comparable whilst technology dissemination for land and water resources development is at a significantly low status. The detailed output tables given in Annex 7.3 i indicate that the emphasis on water resources management research is weak. It was also noted that the activities have increased with time in parallel to the allocation of more financial resources. There is some positive increasing trend of research work undertaken during last three years. However, there is less number of articles published in international journals. As NRMC is a research oriented centre, there should be an internal mechanism to provide funds to encourage scientists to publish research papers in International Journals having non-zero impact factor.

A brief introduction to the activities along with its contribution to the national development is included in the following text.

Table 4: Major Activities Executed by NRMC (2014 to 2016)

Mandate of the NRMC	Year			Total
	2014	2015	2016	
Research on natural resource management - RNRM	1	3	7	11
Technology dissemination for land and water resource development in agriculture- DLMA	-	2	3	5
Provide technical assistance for land and water resource development in agriculture - TLWA	4	5	5	14
Implementation of Soil Conservation Act – ISCA (Soil Erosion Assessment/control/Advices/Legal actions/Farm level implementation (FLI)	5	5	6	16
Maintain 28 agro-met stations island wide and provide quality controlled data to stakeholders (including research)	3	3	2	8
Total	13	18	23	54

4.2.1. Implementation of Soil Conservation Act

Responsibility of the implementation of Soil Conservation Act is vested with the NRMC on behalf of the Director General of Agriculture (DGA). Activities under this were implemented through the collaboration of Provincial Departments of Agriculture. Activities under the Soil Conservation Act were accelerated significantly during the recent past as a result of the allocation of relatively sufficient funds compared to the past. Therefore, it was possible to establish a practical implementation setup with other agencies such as Provincial Departments of Agriculture, Plantation Sector Institutes etc. Activities are implemented broadly under two categories; a) Legal aspects & their improvements and b) Technology Transfer & awareness creation.

- **Legal Aspects & Improvement**

The existing provisions of the Soil Conservation Act No. 25 (1951) & Amended No. 24 (1996) are not at all sufficient to address the present problems of soil erosion and land degradation in the country. Therefore, legal coverage which covers a broader spectrum of land degradation prevention process is a timely need. The NRMC has already submitted a draft new act, namely "SOIL CONSERVATION AND LAND DEGRADATION PREVENTION ACT" to the cabinet and they have submitted the new proposal for a Cabinet Subcommittee of which their suggestions are yet to come.

Implementation of the SCA at field level needs the services of relevant Authorized Officers. Appointment of Authorized Officers within the Central, Uva and Sabaragumwa provinces were made with the participation of the DGA. In Central, Uva and Sabaragumuwa, 136, 105 and 113 officers, respectively, were appointed as Authorized Officers to facilitate and implement activities related to Soil Conservation Act within their mandated areas. In addition, orders were issued to Tea Estates who are violating the Soil Conservation Act. Impact of the action was significant as most of those who received such orders expressed their willingness to abide by the law. Further action is in progress in this regard.

- **Technology Transfer and Awareness Creation**

Field level implementation of soil conservation is a devolved subject under the Constitution of Sri Lanka. Therefore, technology transfer and awareness creation on soil conservation related matters had been implemented through the Provincial Departments of Agriculture (PDA). The NRMC paid attention to develop human and other infrastructural resources of PDAs particularly in Central, Uva and Sabaragumuwa provinces. The NRMC directed PDAs to emphasize more on field level implementation of soil conservation measures, and required trainings were provided at field level itself, if and when necessary by training classes and field days.

The NRMC allocated funds for Provincial Department of Agricultures in addition to implement activities directly in the field. Among these, establishment of appropriate conservation measures in farmers' fields were the main activity. In this effort, not only on individual plot basis but also such activities were carried out in micro-watershed basis. In Kandy, Nuwara Eliya and Badulla districts, 48 conservation demonstration units were developed and activities were initiated in four micro-watersheds. In addition, NRM villages were established at Kotagepitiya, Doragala with the collaboration of Provincial Department of Agriculture of the Central Province. The project was launched with a holistic approach and 30 hectares of land occupied by 60 farmers were mobilized. The NRMC also provide services to the farms of DOA through planning and implementing soil conservation (seed production farms, research farms, ISTI, etc.).

NRMC also provides Technical Assistance and Expertise Knowledge on Soil and Water Conservation and Water Management Plans for different development activities. Their services to establish soil and water conservation measures are sought by various public organizations such as schools, government offices etc. in addition to the private sector. NRMC also make representation at various national committees and provide their expertise. Since they are mandated to implement SCA, their input in development activities is essential to get the approval for development project to get EIA clearance. For example, the NRMC provided technical assistance to many important development activities of national importance such as, "Uma Oya Multipurpose Development" project, "Morana Reservoir Project" in Badulla district, "Yan Oya Reservoir Project", "Moragahakanda Reservoir Project" etc.

NRMC carries out various programmes to create awareness on the importance of soil and water conservation among officers, farmers and public through TV and Radio programmes. Erecting **r**oadside hoards depicting the importance of Soil Conservation, expressing legal provisions and printing various leaflets and handbooks (eg. Handbook on soil and water conservation) and distributing them at various exhibitions also helps to create the awareness. NRMC takes an active part in participating at exhibitions organized by its own department, school, universities teacher training centres etc. However according to the stakeholders, the efforts taken by the NRMC thus far to create awareness on Soil Conservation Act and on the importance of soil and water conservation is not adequate.

The NRMC organizes Training Programmes on soil and water conservation, Land development and related subject areas to develop the capacity of individuals in various organizations. The duration of these programme ranges from 1 to 5 days. The trainees come from diverse organizations such as Sri Lanka Army, Subject Matter Officers (SMO) of the Department of Agriculture, officers of the Mahaweli Authority of Sri Lanka, Government Farms, Tea Small Holding Development Authority, Divisional Secretariats, tea estates etc. In addition, workshops are conducted to disseminate knowledge on soil and water conservations for various groups which include school teachers and students.

4.2.2. Research on Soil Erosion and Conservation

- **Development of multifunctional soil conservation bunds for mechanized rain-fed uplands in the dry zone of Sri Lanka**

In case of mechanized rain-fed uplands, farmers are reluctant to adopt recommended soil conservation bunds as such closely spaced bunds make machinery use difficult. Hence widely spaced and broad based bunds plus tree hedgerows are suggested for this land use. Main aim of this project was to replace presently recommended closely spaced soil bunds with widely spaced and broad based bunds plus tree hedge rows for mechanized rain-fed uplands in the dry zone. Miti-Murunga, Kathuru-Murunga were identified as promising hedge row plants and application of this technology in farmer fields will be conducted using above promising plants. Further investigation is continuing.

- **Assessment of Catchment Scale soil erosion using Nuclear Techniques**

Lack of information on soil erosion status in agro-ecological regions under different land uses is one of the major drawbacks in successful implementation of soil conservation programs. Current recommendation of specification of soil conservation measures is quite old and with the changing climate, these specifications need to be revised for successful mitigation of land degradation of the country. Assessment of soil erosion in selected watersheds of Rathnapura and Matale districts had been carried out using radio isotopes to identify the land uses that are more responsible for soil erosion. Out of four land uses selected in Ratnapura district tea recorded the highest soil erosion followed by rubber. Natural forest and lowland paddy recorded the soil deposition rather than soil erosion. Data analysis of soil erosion under different land uses (Shifting vegetable cultivation, Low land paddy, Pepper Spice gardens, Coconut plantation and Natural forest) in Matale district is in progress.

4.2.3. Use of Agro-Meteorological Data of NRMC

The NRMC maintains 30 agro-meteorological observation stations along with 80 rain gauging stations. This information is also regularly sent to the Department of Meteorology. Necessary arrangements were taken to establish new meteorological equipment and appropriate actions were taken to improve data collection procedure. The database was updated by computerizing quality assured data. Meteorological data were issued for various departments, institutes, cooperate sector and individuals on demand. It is noteworthy to mention that the NRMC in engaged in this commendable act of providing these services without any financial remuneration.

The output provided by the NRMC using this metrological information during last three years is briefly described below.

- **Issuing of long-term climate forecasts at regular intervals**

One of the most important services provided by the NRMC is to issue weather forecasts to officials and farmers with regard to the onset of cultivation season. About ten to twelve weather communiqué are issued at regular intervals in consultation with the Department of Meteorology during a year explaining probable weather conditions on approaching months. These information were disseminated to regional stations and all district level officers of the department and provinces

through the departmental communication network to plan the field activities accordingly and aware the farmers.

- **Enhancement of OFC, vegetable and fruit during off season and non-conventional areas using agro-ecological information.**

Sri Lanka has 46 agro-ecological regions with different rainfall distribution patterns along with variety of soil and other bio-physical environmental characteristics. Even though attempts have been made to harness the potential of this diversity for food crop production since ancient times through various means, still there are some regions in the country where adequate attention has not been given to utilize this potential to enhance the agricultural productivity. Therefore, a study was undertaken to enhance the production of other field crops, vegetables and fruits by identifying non-conventional areas and locations where food crops can be cultivated during off seasons to ensure a continuous production. The climate, soil and terrain characteristics were taken into consideration to determine the suitability of an area for respective crops. From this study 20 locations had been identified for vegetables, 08 locations for fruit crops and 26 locations for other field crops.

- **Recent trends of extreme positive rainfall anomalies in the dry zone of Sri Lanka**

A study was conducted in the Dry zone of Sri Lanka, to identify the trends in occurrence of positive extreme rainfall anomalies, using daily rainfall time series from 1990-2014 collected at 13 rain gauge stations scattered in all major agro-ecological regions of the Dry zone. It is revealed that an apparent trend of these extreme positive rainfall anomalies is discernible, especially during SWM and NEM rainfall seasons. This trend has been clearly evident during last 5-year period from 2010-2014. It may likely to inflict significant implications on the agricultural production in the region in terms of both quantity and quality, as SWM and NEM seasons coincide with the reproductive phase of the crops grown in both *Yala* and *Maha* cultivation seasons in the Dry zone.

- **A glimpse of rainfall regime of Sri Lanka in 2014**

In the light of high variability of seasonal rainfall in Sri Lanka during recent past under a changing and variable climate, this study has attempted to examine the spatial and temporal pattern of rainfall anomalies experienced during year 2014 which resulted several negative impacts on the economy. It has revealed that 2014 *Yala* season has been a drought burdened season in all over the country. However, due to availability of good water storages in almost all irrigation tanks and reservoirs in the country on account of heavy rains during December, it did not result in severe depletion of water levels of those surface water bodies.

- **Relationship climate events with the incidence of weeds and insect pests in rice (Oryza sativa L) cultivation in Sri Lanka**

Weeds and insect pests are the key yield determinants of rice (Oryza sativa L.) that can be influenced by climatic parameters. The changes of ambient temperature and rainfall regime from 1982 to 2012 during two major growing seasons, Yala (March to August) and Maha (September to February) and their relationship with incidence of weeds and insect pests of rice were studied in three major rice growing districts of Sri Lanka, namely Anuradhapura, Polonnaruwa and Kurunegala. Occurrence of extreme climatic events during the study period was identified in relation to the base period (1961–

1990) and their relationship with El Niño and La Niña events (ENSO) was examined. There was no distinct linear correlation between climatic variables and, weed and insect pest incidences. However, an apparent relationship was evident between occurrence of extreme rainfall events and ENSO events. Moreover, it is likely that weed and insect pest incidences would be relatively higher during ENSO years.

4.2.4. Remote Sensing and GIS

The Remote Sensing and GIS section provide many outputs to support decision making abilities of the DOA such as yield forecasting, crop suitability, land use mapping, dissemination of information etc. Some of the outputs obtained using remote sensing and GIS techniques are briefly described below.

- **Paddy extent and yield forecasting with high resolution satellite imagery**

This National Agriculture Research Program (NARP) funded research project was initiated aiming at developing a real time national forecasting system for rice cultivation extent and production in Sri Lanka. High and moderate resolution satellite imageries were tested in GIS to demarcate the paddy lands.

Preparation of digital maps of paddy cultivation lands and development of rapid assessment approach for identification and demarcation of rice cultivated lands in each season, approach for quantification of yield levels in rice cultivated land and production of regional maps showing forecasted yield levels are the main objectives of this study. Paddy land maps has been updated in Ampara and Polonnaruwa districts using on-screen digitizing with high resolution satellite images. Updating paddy land maps of Hambanthota, Anuradhapura, Kurunegala and Batticaloa are in progress. After extensive field verification paddy-land maps of Ampara district has been finalized and ready to print as a paddy-land atlas and will be available in printed form as well as digital document format. Mapping paddy cultivation progress during this season in Ampara at pilot scale is in progress.

- **Toolkit for regional crop yield forecasting and climate change impact assessment**

The main objective of this project is to monitor and forecast the crop condition with natural and changed climatic conditions in Sri Lanka. Weather database was developed using 30 years (1981-2012) daily data covering whole of Sri Lanka. Then spatial interpolation in ArcGIS software was used for development of data sets for each grid cell as required by CRAFT software. Daily data on rainfall, maximum and minimum temperature and sunshine hours were compiled and weather data sets were developed for each grid (891) file separately. In addition, soil property data, crop parameters, fertilizer application, historical yield records and planting date files were prepared for each grid. Preliminary yield maps were generated for testing for each grid cell and evaluation of CRAFT toolkit was done. The prediction can be done on district basis and CRAFT software calibration and validation need to be completed.

- **A management information system (MIS) on crop suitability recommendation for *grama niladari* divisions**

Selecting of most suitable crop or combination of crops to suite the agro-ecological environment lead to better agriculture production in the country. A user guide on crop recommendation pertaining to

each *Grama Niladari* Divisions based on the Agro-Ecological Region map of 1975 was developed by the Department of Agriculture in 1990 to fulfil this requirement. This user guide was basically developed for cash crops. However, this guide has not been updated and extracting information from this book is not user friendly for quick reference. Therefore, Management Information System (MIS) for crop recommendation was developed as desktop software "CropRec" and available as a free web base information system. The information on crop recommendations were updated based on recent publications and information collected from plant breeders, agronomists, extensionists and scientists. As web base software, it can be used for easy and fast dissemination, sharing, displaying and data processing which helps information in dissection making for selecting suitable crops, cropping patterns at commercial scale farming systems.

- **Identification of drought and high temperature prone agriculture areas to characterize spatial and seasonal agro-ecological environment for adaptive measures**

Drought is an insidious hazard of nature. It is often referred to as a "creeping phenomenon" and its impacts vary from region to region. Onset and end of drought is difficult to determine. Drought condition can be traced using crop condition assessment based on vegetation indices derived from remote sensing satellite data. MODIS satellite data acquired during past 15 years (2000-2015) is evaluated to assess drought frequency and map drought prone agriculture areas. Agro-ecological environment are evaluated for each drought prone region to formulate strategic recommendation for reducing crop failures by suitable crop selection and adjusting crop calendars targeting optimize food production and increase livelihood. Satellite imageries have been acquired from free web sources for 2000–2014 and started pre-processing and development of vegetation indices. The study will continue for 3 years (2016-2018) in collaboration with FCRDI MahaIlluppallama.

- **Web GIS portal for agricultural information dissemination**

The objective of this project is to develop web-based interactive information and mapping portal for exploring data, information and maps related to Agriculture. Open source GIS software will be used to generate this web portal. A trial web GIS platform was created from Arc GIS account and platform link to agriculture department website. (www.agridept.gov.lk /crop suitability/ webGIS platform). The expected outputs are agriculture related special data access and dissemination, special data exploration, geo visualization and special data processing, analysis and modelling.

4.2.5. Soil Fertility and Land Use/Land Suitability

- **Soil fertility status of rice lands in the lower Nilwala river basin**

The lower Nilwala river basin has been identified as acid Sulphate affected area causing low productivity of rice lands. A study was conducted to identify soil fertility limitations in the above rice lands and their geographic spread to develop strategy for enhancing productivity of rice. Construction of sea water barriers to prevent sea water intrusion during the dry period and use of salinity resistant varieties are possible measures to overcome salt affected situation. Proper identification of different land classes and development of management practices for each land classes have to be done to overcome the problem.

- **Land suitability study for agricultural crops in Sabaragamuwa province**

Assessment of land degradation and identifying hot spots is needed for prioritizing soil conservation areas for sustainable land management. Hence, preparation of erosion hazard maps and regional scale crop suitability analysis were very important in terms of reducing land degradation in central highlands. Although land degradation assessment for Central and Uva were conducted, there was no proper assessment in Sabaragamuwa Province. Hence, the major objective of this research is to assess land degradation status and conducting regional scale crop suitability analysis and mapping for Sabaragamuwa Province. The results showed 61% of land cover falls onto the extremely high and very high categories. Therefore, proper land use planning and appropriate regulations for illegal gem and sand mining should be taken to reduce soil erosion and increase the land productivity in Sabaragamuwa province.

- **Assessment of ecosystem services in major agricultural land uses**

Land degradation has been a major issue in Sri Lanka particularly in the face of recent climatic change and a need has been arisen in restoring them in considering their ecosystem services. Main aim of the study was to assess major ecosystem services of major three land uses namely Kandyan forest garden system, cascade system in the dry zone and the *Ovita* system in the low country wet zone. Site selection, developing structured questionnaire, pretesting the questionnaire have been completed. Data and information collection is in progress.

- **Investigation on land fragmentation effects on the loss of bio diversity in Kandyan forest garden system**

The traditional Kandyan forest gardens in Sri Lanka are rich in bio diversity. With the population expansion in wet zone of the country, fragmentation of traditional such home gardens has become a threat to loss of bio diversity in the system. The study showed that the occurrence of most of permanent crops in Kandyan forest gardens has been reduced due to land fragmentation. It also showed the need of introducing dwarf type of crop varieties in order to maintain plant density.

- **Agricultural land management for improving irrigation efficiency and soil fertility in agro-well based small holder farms in Sri Lanka**

Agro-well based small holder farms in Sri Lanka show drawback in crop cultivation. Agricultural land management for improving irrigation efficiency and soil fertility help partly to bring this farming sector back to productive stage. Introduction of micro irrigation technologies for crop irrigation, soil test based chemical fertilizer use and compost application were identified as effective technologies for improving soil fertility and increasing irrigation efficiency of agro-well farming systems in the dry and intermediate zones. A methodology was developed to promote of micro irrigation technologies aiming small holder agro-well farms.

4.2.6. Water Quality

- **Monitoring water quality of major streams in central highlands in Sri Lanka**

Improper land use with soil erosion and fertilizer use causes adverse effects on stream water quality. Hence, stream water quality will reveal degree of soil erosion and fertilizer use in different land uses in catchment areas and help prioritization of soil conservation programs. Main objective of the study is to assess degree of soil erosion and fertilizer use in major agricultural land uses in Mahaweli catchment. Results showed sediment load coming from urban areas is greater than agricultural areas during most of months in the year with few exceptions. The exceptional months were November and December. The reason for higher sediment load coming from tributaries could be due to land preparation activities in farming lands during said months. Further, among tributaries studied, sediment discharge from the Badulu oya, Uma Oya and Belihul Oya were significantly higher than the other tributaries. It could be due to year round vegetable cultivation being practiced by vegetable farmers and tea growers. Hence, above streams can be identified as critical watersheds with respect to soil erosion in the Central highlands.

- **Investigation on the effect of drinking water quality on the occurrence of CKDu in dry zone settlements**

The Chronic Kidney Disease of unknown aetiology(CKDu) has been a major health issue in dry zone settlements and the causal factor and preventive measures have not been clearly identified yet. One possible factor is the adverse effect of drinking water. The objective of the study was to investigate the effect of selected chemical parameters of drinking water on the occurrence of CKDu. It is revealed that ground water in CKDu recorded areas shows significantly higher concentrations of Na^{+}, F^{-} and Cl^{-} and significantly lower concentrations of Ca^{++} and Mg^{++}. Further, it showed the superiority of surface water (tank and river water) over ground water for drinking purpose. Hence, till the causal factor is found, it is recommended to use purified good quality surface water for drinking purposes.

5. Findings and Recommendations

5.1. General

The NRMC with a responsibility to implement Soil Conservation Act and provide information on the onset of cultivation to farmers, in addition to research, training and providing technical support to many stakeholders, has contributed to the national development in spite of a severe dearth of human resources. The present work load had been undertaken primarily by 01 Deputy Director and 06 Senior Researchers though the approved carder reach numbers 06 and 26 respectively for the said posts. There is a danger with respect to the unhindered NRMC service in each of these nationally important areas of activity because of the impending retirement of these trained, highly qualified staff expected to take place in the near future. Hence the team reemphasize urgent actions with due consideration.

Implementation of Soil Conservation Act is important in formal approval of development projects through the CEA. If the project is located within the Conservation Area gazetted by the Minister of Agriculture, a clearance from the NRMC is required before granting the final approval by the CEA. On average, 300 such approvals are granted by the CEA with the support of the NRMC. The team recognised the need to expand this service to other areas with the ongoing increase of development projects and the expansion of the conservation areas.

Maintenance of agro-meteorological stations and providing data to meteorology department and other stakeholders is also a regular activity of NRMC. This input has become more important in the recent past in view of climate change and associated high rainfall variability. Changing weather also has a severe impact of food production. With the DOA being a responsible agency at national level the prediction of harvest by NRMC research becomes very important to assure food security,.

Considering the above, it is vital to take action based on the findings of this review of NRMC It is important to ensure that the NRMC has sufficient strength in terms of financial, human and legal resources to provide services according to the objectives stipulated since its establishment in 1974. Details of findings and recommendations under 8 subheadings, as indicated in the review guidelines are briefly described below.

5.2. Institutional Response to External and Internal Environment in Planning Organizational Strategy

There is a danger of not fulfilling institutional aspirations according to a clear mandate as a result of the unavailability of a strategic plan. Though the institution is very responsive to government policy changes and is very accommodative with respect to urgent state requirements, the lack of a strategic plan is detrimental to the long-term sustenance of the institution. Hence it recommended for the NRMC to clearly identify its mandate, develop its strategic plan and allocate sufficient resources with a long-term vision. Input from external stakeholders was found at a very minimum level in all associated aspects. Therefore, it is recommended to incorporate mechanisms to entertain views/needs/ideas of external stakeholder to review and update policies and plans of the organization. It is also important to formalize the internal review process with a proper documentation for post evaluations.

5.3. Planning S&T programs and setting priorities

Most of the programmes are planned according to national development goals while some of them are without a direct link. Therefore, it is recommended to formalize the process of programmes and priority setting with staff participation with proper documentation. The review identified that the socio economic aspects and multidisciplinary approaches are considered to a lesser extent in programme planning, whist commercialization aspects had never been taken into account. These have to be duly considered and incorporated for effective and efficient program planning and execution.

5.4. Planning S&T / R&D Projects

As indicated above, a well-documented set of medium-term plan, corporate plan, and strategy must be prepared and practiced to guide project selection and planning. Documentation of research outputs, evaluation results and remarks must be placed in a database and accessible to staff for strategic planning and programme planning work. In line with the policy of the Government, the NRMC in its strategic plan need to explore the possibility to incorporate partnership with private sector and associated programmes. Collaboration with other institutions to prepare multidisciplinary and multi sector projects.is also a strong recommendation of the review.

5.5. Project management and maintenance of quality

There is inadequate formal procedure in the NRMC for project management and quality assurance. Hence it is required to establish a project based formal monitoring mechanism similar to institutions such as HARTI, NSF etc. A formal quality assurance process needs to be developed, established, documented and practiced to ensure quality in the long-run. It is required to develop laboratory manuals and step by step guidance for field procedures. NRMC should make attempts to obtain accreditations to its laboratories to ensure recognised outputs. Software requirement evaluation should be carried out and provisions must be made for procurement, while providing allocations for international data bases, journals subscriptions etc., essential for furtherance of research.

5.6. Human Resource Management

This is the most important aspect which requires urgent attention. As indicted before, inadequate number of qualified staff has seriously affected the organizational performance. It is also found that not a single staff member has been trained during the last three years to achieve qualifications at postgraduate level. Therefore, it is recommended to recruit staff as early as possible and train them in such a way that they could perform the mandated activities of the institution. Until such time, the institutional leadership should take adequate steps to pursue a solution with higher authorities and identify alternatives to ensure uninterrupted progress of the programs. Recruiting contractual staff (possibly those with adequate experience and had retired from service), enrolling water engineers and

soil scientists on secondment mainly for water and soil management research, outsourcing research, collaboration with universities and other research institutions etc. could help relieving the pressure of remaining staff. In addition, it is important to identify training needs, seek financial allocations and then design capacity building programs falling in line with the strategic plan.

Since there is no central data base of staff, it is recommended to commence the development and maintenance of a central electronic database and an information system to access all institutional and employee information. It is found that steps to enhance the social interaction and project awareness of non-technical staff through periodic field visits, demonstrations, etc. would help to improve the performance of projects. Developing performance indicators and guidelines for an appraisal scheme identifying and designing a reward and incentive scheme to motivate staff is also recommended.

5.7. Management of organizational assets

The NRMC has a good reputation in proving services to many stakeholders even with its limited resources. To sustain and improve the institution, it is important to revisit and redefine the mandate and then to develop a strategic plan to cover the complete geographic extent expected by the mandate. This should be complemented by recruiting suitable and adequate staff to cover all mandated sectors. It is also important to establish a suitable disbursement plan along with a monitoring mechanism falling In line with the desired progress of programs. The economic contribution from the NRMC to conserve natural resources needs to be analysed and compared with cost recovery to demonstrate the benefits accrued to the to the nation. It is also advisable to establish a culture to appreciate the value of Intellectual Property rights associated with the products of the institute.

5.8. Coordinating and integrating the internal functions/ units/activities

The proposed institutional plan by the NRMC as given in Figure 2, requires to be established after proper consultation of stakeholders. Formal meeting and documentation procedures must be established. Planning committee should be broad based including stakeholders and internal technical and non-technical divisional heads. Clearly defined documentation identifying functions of different units must be developed and associated staff awareness programs must be conducted. This should be followed by developing and practicing TOR/work schedules.

The management of information dissemination requires careful planning. It was highlighted during stakeholder meetings that they are not aware of the mandate of the institutions/information available and services that NRMC provide etc. Therefore, it is recommended to develop a information dissemination strategy not only for farmers and scientific community but also to address the needs of policy makers at the national level. A well-structured plan is needed for information dissemination. In addition, a well-structured set of capacity building programs is required for technology transfer.

5.9. Monitoring, evaluation and reporting procedures

As at present, monitoring, evaluation and reporting procedure is less satisfactory. Therefore, it is important to take urgent steps to develop procedures to periodically monitor and evaluate its own activities. A well-structured MIS must be designed and developed to include costs, staff, progress, and Results, etc. while specifically embedding the data and information archiving. A structured reporting system must be in place and suitably incorporated to the NRMC MIS. An annual seminar summarizing S&T results and other outputs of individual divisions must be encouraged while obtaining stakeholder feedback. External stakeholder contribution to the M&E process of the institution must be placed commending from the strategic plan formulation. There is a strong need to internalize the monitoring and evaluation processes which would certainly help to develop a quality culture within the institution.

6. Concluding Remarks

Through a series of consultations with the staff of NRMC and its stakeholders, the need of an expanded mandate of NRMC to cover the entire country with an amended Soil Conservation Act that covers the entire country was recognised. This is mainly because the soil erosion and conservation is not limited to the hill country. Accordingly, it is recommended to locate at least one officer attached to NRMC at each province. Having considered the recruitment of personnel for all existing cadre positions while addressing new immerging issues, a new organizational arrangement has been proposed by the NRMC (Figure 2). This is in line with the findings and recommendations of the review team which strongly endorses the proposal. However, all principal scientists are under the Director whilst no divisions allocated for principal scientists. All the divisions come under the Director or Additional Director. Therefore, it is important to have internal as well as external stakeholder consultations to formulate an acceptable institutional arrangement before placing this with the management service department for compliance and approval. It must be also emphasised that this institutional reform must be carried out along with the recommendations made under the 8 subheadings ensuring that NRMC could discharge its national duties with greater effectiveness and efficiency.

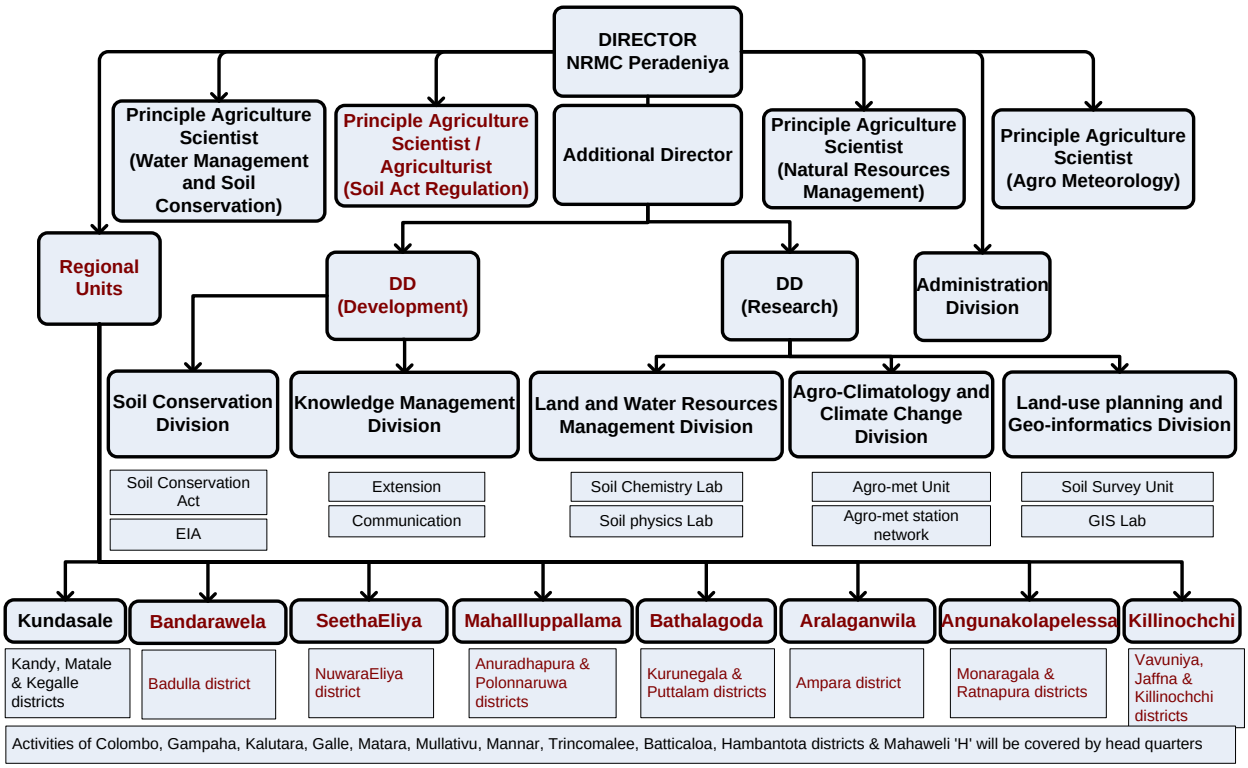

Figure 2: Proposed Organisational Chart of NRMC

The recommended activities should commence with the development of a corporate plan/strategic plan with redefined mandate, vision, mission, goals, strategies, activities having a clear time frame. As indicated previously a wider stakeholder participation needs to be ensured for the success of these activities. It is mandatory that the DOA and GOSL fully endorse this reform process with required administrative support, legal provisions and financial allocations.

7. Annexes

Annex 7.1: Stakeholders' Meetings
Attendance List of the 01st Stakeholders' Meeting

Table 5: Attendance List of 1st Stakeholders' Meeting of NRMC @ In service Training Institute - Gannoruwa on 10th November 2017

No	Name	Institute/ Company	Designation	Contact No
01	D M Ranaweera	RDA	Engineer	0714798447
02	T B Maheepala	Dept. of Metrology		0714435906
03	M M M Aheeyar	IWMI	Research Assistant	0773695322
04	K G Janaka Karunaratne	NSF	Assistant Director	0714491582
05	J M I H Jayawardena	Mahaweli Authority	Assistant Director	0719503349
06	W M M Priyanthi	LUPPD	Deputy Director	0714442155
07	M A K Munasinghe	NRMC	Add. Director	
08	H K S Dilhasan	District Secretariat	Asst. District Secretary	
09	G G L Samarasinghe	HARTI	SRO	0718078209
10	P Wijeratne	SLLR & DC	Asst. General Manager	
11	H L R N Seneviratne	RDA	Engineer	0714152891
12	W B Palugaswewa	Irrigation Dept	Director	
13	K W Samarakoon	NASTEC	Senior Scientist	0702558823

A Photograph taken at the Stakeholder meeting is shown by Figure 3 .

Observations and suggestions from 1st Stakeholder meeting

- There were 10 institutions, as listed above, represented the stakeholders. Out of them Meteorological Department has the closest interaction with the NRMC since NRMC provided them with weather data from 28 Agromet stations. The NRMC is involved in collaborative projects and willing to extend significant support services. Met Department has an ongoing data sharing program with NRMC. It is credible that NRMC data sharing is free of charge. NRMC need to address the lack of cadre for data collection. There are issues with equipment. Met Dept helps NRMC to calibrate and repair the equipment and train data observers. In addition met department helps to identify proper site locations and maintain observation sites according to the standards of World Meteorological Organization (WMO). The present management of NRMC has taken relevant actions to develop institute infrastructure. Renovation of the existed building with a conference hall and new soil physics lab is some of the examples in this regard.
- NRMC helps to train LUPPD staff on soil conservation, protecting water sprouts etc. NRMC is represented in LUPPD policy committees. There should be a strong input to commence the practice of policy papers by NRMC. LUPPD is of the opinion that the gap of not receiving a NRMC formal input must be filled at the earliest. Visibility of NRMC is poor, need a website with research outputs. Need to develop soil a soil conservation plans and get others support to implement them.
- The Mahaweli Authority of Sri Lanka (MASL) obtain services of NRMC for soil testing and soil suitability surveys (using only physical parameters) of Mahaweli Farms in addition to geo-referenced them using GIS. It is suggested that these informal links must be converted to formal collaborations.
- IWMI has appreciated the intellectual input from the staff members of the NRMC at workshops and scientific forums to share knowledge. Though there is no involvement of IWMI with the NRMC, it is suggested to improve the collaboration. There was also a suggestion to made information available on-line to facilitate the information sharing.
- Thus far NRMC has no research dissemination in association with NSF. NSF is of the opinion that the sharing of knowledge needs significant improvement and also recommends establishing a research action plan to direct activities in line with the assigned mandate, enhancing the human resources, and taking authentic information.
- The last two stakeholders in the attendance list, i.e. SLLRDC and RDA have least involvement with the NRMC. Both agreed that the NRMC must take steps for awareness enhancement. SLLRDC is of the opinion that the data sharing must be encouraged.

Attendance List of 02nd Stakeholders' Meeting

Table 6: Attendance List of 02nd Stakeholders' Meeting of NRMC @ In service Training Institute - Gannoruwa on 10th November 2017

No	Name	Institute/ Company	Designation	Contact No
01	S M A Senanayake	CEA – CPO Polgolla	Deputy Director	0716859652
02	M A S R Danawansha	Dept of Prov. Education Kandy	Asst. Director	0703459526
03	M F Ramanayake	Weragoda, Beligala		0717745950
04	A Wijekoon	Home Lands	Brand Manager	0710299125
05	M A K Munasinghe	NRMC	Add. Director	0718010058
06	H K S Dilhasan	District Secretariat	Asst. District Secretary	0779199672
07	A M D B Athauda	Urban Dev. Authority	Asst. Director	0718072133
08	T M Karunawathi	Agriculture Office - Badulla	SMO	0718283005
09	Upul Ratnayake	Prime Lands Pvt Ltd.	AGM	0714756046
10	Gihan Ranaweera	Prime Lands Pvt Ltd.	Executive	0710215299
11	G Gunaratne	Weliwita, Ihalagama		0812064992
12	Dayasiri Bogahawatta	Greenwood- Nawalapitiya		0777247320
13	K M Abayasiri	NRMC	P S NRM	0779438475
14	M H B P H Madana	D O A / NCP	Director	0714133402
15	I M Kanthilatha	N H N A Kandy	Senior Manager	0779696313
16	A G Chandrapala	NRMC	Asst Director	0772818096
17	K W Samarakoon	NASTEC	Senior Scientist	0702558823

A Photograph taken at the Stakeholder meeting is shown by Figure 4.

Observations and suggestions from 2nd Stakeholder meeting

- The Central Environmental Authority has a close relationship with NRMC since 1994. Since NRMC is mandated to implement Soil Conservation Act, the approval has to be taken by the NRMC to approve EIA reports. Issuing environmental certificates for new land development projects is one of the tasks performed by CEA. The NRMC involves with the Environmental impact assessment process pertaining to the environmental certificate issuing process. Annually, 300 assessments are undertaken in the Central Province.

- The CEA suggested to include soil erosion from non-agricultural lands as well in the Soil Conservation Act and to decentralize NRMC activities to provinces.

- The NRMC interacts with schools in central province through many activities, including conducting teacher training programs, providing guidance when organizing and also conducting exhibitions, and training students for competitions. NRMC contributes immensely for the knowledge dissemination through school exhibitions through demonstrations and providing leaflets, samples, etc. NRMC supports implement soil conservation practices on lands of schools, that helps to inculcate the importance of soil conservation in school children. It was mentioned that school principals are aware on the existence and functions of NRMC. Conducted 8 activities during 2015 as the international year of soils.

- It is noted that there is ack of awareness among the school children on the mandate of NRMC. It was suggested to include more information on SCA and implementing authority in Agriculture Curriculum/AL.

- In line with the mandate of NRMC, District Secretarial office connects to activities conducted at divisional level. Basically, the DS office coordinate, soil conservation awareness programs, development projects and review and reporting outcomes of activities. The DS noted the lack of a) awareness among people on the Soil Conservation Act, b) awareness on SCA among government officers who are dealing with land development projects , c) of support of NRMC to review the success of village level programs, and d) support by NRMC to implement/conduct village level programs on soil conservation. The DS suggested NRMC to have a staff capacity at village level to make aware about SCA among people and government officers. They also suggested NRMC to issue circulars on soil conservation to institutions.

- Provincial Departments of Agriculture interact with extension division of NRMC to implement soil conservation programs and training sessions. Further, NRMC supported to establish demonstration sites showing soil conservation techniques. These activities have motivated farmers to consider about soil conservation practices at farm level. The PDA noted that lack of officials attached to the provincial department of agriculture limits the implementation of soil conservation practices in farmer fields and also monitoring of already established structures.

- The PDA suggested strengthening the NRMC as an Institution, decentralizing its activities by recruiting officers to NRMC and allocating them in the offices of PDA, minimum 1 person for each province. There was a suggestion or NRMC to a) impose SCA in the dry zone enforcing

farmers to adopt soil conservation practices, b) establish more Demonstration plots at in-service institutes, and c) train young and newly recruited people on soil conservation.

- The National Housing Development Authority in Kandy District appreciated the importance of soil conservation in their housing projects. A poor involvement of NRMC in government land development projects conducted by Housing Development Authority was noted, mainly because of implementing soil conservation, storm water management strategies are not strictly adopted in such projects. The Urban Development Authority also has a poor interaction with NRMC when implementing development projects, especially in Urban Development Activities Both the NHDA and UDA have suggested building up of awareness on Soil Conservation Act, storm water management and NRMC among government officials. Further steps should be taken to implement soil conservation and water management practices when implementing government projects and train Technical Officers. In addition to soil erosion, include riverbanks, water springs, and catchment areas as well.

- Prime lands (PVT) Ltd., and Home Lands (PVT) Ltd., two private sector stakeholders, involved with selling lands and housing construction projects, stated that the NRMC assisted them in providing soil conservation and storm water management guidelines for land development projects implemented in Central province. Delayed response from CEA is quoted as a major issue in getting its service. They suggested to expedite the process of approval and provision of technical expertise and monitoring needs. NRMC interact with Metal Quarry owners when issuing conservation guidelines as part of the environmental certificate (issued by CEA). It was noted that Monitoring of the implementation of such recommended practices are necessary.

- Farmers who attended the meeting were aware of the importance of soil conservation and storm water management. One of them interacted closely with the NRMC as his field has been selected to implement a soil conservation demonstration plot. It was suggested for the NRMC to follow up such activities in order to disseminate the information to other farmers, i.e. bringing other farmers to the demonstration site. They were of the opinion that providing funding would encourage them to adopt soil conservation practices in their fields.

- The General Suggestions from all stakeholders are listed below;

    1. NRMC should address conservation of Lands from the point of Land Degradation
    2. Allocate at least 1 officer attached to NRMC at provincial/district level
    3. Involvement of developing lands in Schools, and establishing conservation models at school level, short films.
    4. Conducting awareness programs on activities by NRMC for government as well as private sector
    5. Provision of technical expertise to private institutes which are involved with land development activities.
    6. NRMC should be strengthened as a national institute with required resources to implement and monitor Soil Conservation Act.

Photographs Taken at the Stakeholder meetings

Figure 3: Stakeholder meeting on 2nd November 2017 at HARTI, Colombo

Figure 4: Stakeholder meeting on 10th November 2017 at In service Training Institute, Gannoruwa

Figure 5: Meeting with the Senior Staff of the NRMC

Figure 6: Meeting of the support staff of the NRMC

Figure 7: Observing the facilities at the NRMC

Annex 7.2: Management Assessment Tabulations

Institutional Response to External and Internal Environment

Table 7: Institutional Response to External and Internal Environment in Planning Organizational Strategy

Management practice	Level of Practice (Performance Indicators)			Comments / Evidence
	Strong	Moderate	Weak	
Government policies and development goals are used/ considered to establish goals and plan organizational strategy for the institution		*		Current organizational strategy need to be well documented with stakeholders consultation
The organizational mandate (as specified by the relevant Act) is considered in strategic planning		*		Gaps in the organization mandate needs to be clearly identified and addressed with adequate resources.
The institution is responsive to changes in Government policies and strategies	*			There is evidence of strong involvement and consideration
Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning			*	SWOT analysis has been done (Annex 7.4). However, a strategic plan needs to be in place.
Stakeholders needs are taken into consideration in strategic planning		*		Only the internal stakeholders are involved. Inadequate institutional stakeholder consultation.
The Board of Governors is involved in strategic planning		*		There is no Board of Governors, instead Directorate of the DOA. However, there is inadequate evidence to show that the Directorate is involved in strategic planning.
The extent to which staff members are involved in strategic planning		*		A formal mechanism should be established.
Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning		*		Funding is not considered as a constraint.
The extent to which policies and plans of the organization are reviewed and updated		*		Only an informal institutional review is carried out.

Planning S & T programs and setting priorities

Table 8: Planning S & T programs and setting priorities

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
National development goals are considered in planning programs & setting priorities		*		Ad-hoc planning and absence of prioritization scheme.
Board of Governors participate in planning and priority setting of program		*		Only a Directorate which relies on the NRMC programmes
The extent to which the staff of the institution participate in programme planning and priority setting		*		Inadequate documentary evidence on programmes and priority setting with staff participation.
Stakeholder interests are considered in programme planning		*		Only the internal stakeholders are involved. Poor institutional stakeholder consultation.
The extent to which programmes are planned and approved through appropriate procedures			*	Formal procedure must be established.
The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes		*		Funding is not considered as a constraint.
The obtaining of necessary equipment is considered in planning programmes	*			All available equipment has been considered when planning programmes.
Stakeholders are represented in the institution's planning and review committees.			*	Only the internal stakeholders are involved. Not adequate institutional stakeholder consultation.
The extent to which socio economic and commercialization of aspects are considered in programme planning.			*	No framework to consider the said aspects.
Effectiveness and efficiency of institutional procedures in approving new S& T programmes.			*	No documented procedures are in place

Planning S& T / R& D Projects

Table 9: Planning S& T / R& D Projects

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The staff is provided with guidance for project planning		*		No documentations of procedure
Previous research results/data are used for planning projects		*		Previous research results are captured through personal data bases.
The extent to which the institution follows a formal process for preparation, review and approval of projects		*		No documentations of procedure. Only meeting records.
The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning			*	Documented medium-term plan, corporate plan and strategy are not available.
Multidisciplinary projects/ activities are encouraged by the institutions		*		Inadequate identification of multidisciplinary approaches in project planning
Foreign collaborations are encouraged and incorporated in planning.	*			Most of the external projects are with foreign collaboration.
Partnership with private sector is encouraged by the institution			*	No mechanism.
The extent to which development research/activities are considered in planning projects		*		A structured effort must be in place to provide research outputs for development work.
The extent to which basic research are considered when planning projects		*		There is evidence that basic research have been undertaken.
The degree to which adverse effects on environment are considered in planning projects	*			The mandate of the institution is conservation. All projects/programmes are aligned towards the mandate and the institution support CEA in the project approval process.

Project management and maintenance of quality

Table 10: Project management and maintenance of quality

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The effectiveness of the procedures for resource allocation at different levels (organization, departments, program etc.)		*		No prior planning, On demand allocation, Thus far no reported problems.
Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects		*		Satisfactory for selected scope, requires complete requirement identification according to the mandate.
The effectiveness of administrative procedures and support for project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)		*		Document the administrative procedure aligning with the mandated activities
Formal monitoring and review processes are used to direct projects towards achievement of objectives			*	Formal monitoring process is not in place
The extent to which the researchers are supported by the required technical / field staff.			*	Review visit revealed inadequate support staff as reported by both senior and technical staff
Ensuring that established field / lab methods, and appropriate protocols are used		*		No laboratory manuals and accreditation
Research projects/ S& T activities are completed within the planned time frame.		*		Moderately acceptable progress monitoring mechanism
Ensuring that scientists / researchers have access to adequate scientific information (scientific journals, internet, international databases, advanced research institutes, universities etc.) that strengthens the quality of research.		*		Internet available, complete access to institutional data base.
The extent to which quality assurance practices are followed by the institutions			*	No evidence of formal quality assurance
Ensuring that researchers/ scientists have access to computers and necessary software		*		In sufficient numbers of licenced software

Human Resource Management

Table 11: Human Resource Management

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)			*	No central information database
The institution, plans and updates its staff recruitments based on programme and project needs			*	The problem of inadequacy of staff is beyond the control of the institution
The effectiveness of the selection procedures and the schemes of recruitment			*	Incompatible with most undertaken programs.
Training is based on institution and program objectives and on merit,		*		No training need assessment and pre-plan for capacity building.
The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.		*		There is evidences of rearranging space, logistics, equipment.
The effectiveness of staff performance appraisals			*	No staff performance appraisals other than annual increment recommendations
The effectiveness of rewards and incentive schemes in motivating the staff			*	Not in existence.
The effectiveness of managing staff turnover, absenteeism and work interruptions.		*		No significant issues were highlighted.

Management of organizational assets

Table 12: Management of organizational assets

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The ability of the institution to carry out its mandate and the assigned statutory powers		*		Moderate performances due to lack of clear mandate, strategic plan and inadequacy of staff
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.	*			Presently available infrastructure is well maintained.
Vehicles and equipment (lab, field, office) are properly managed and maintained.		*		Field equipment has room for improvement
The effectiveness of procedures to ensure that equipment are in working order		*		No formal procedure for verification
The effectiveness of the institution's overall strategy in generation and proper utilization of funds		*		Underutilization of allocated funds.
The extent to which the institution identifies opportunities for income generation and cost recovery			*	Ecosystem services have not been quantified and valued.
The extent to which the intellectual property rights of the institute are protected			*	No IP rights appreciation

Coordinating and integrating

Table 13: Coordinating and integrating the internal functions/ units/activities

Management Practice	Level of Practice (Performance indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The extent to which institution is evaluated internally and restructured based on current needs			*	Some efforts noted but not effected.
The effectiveness of internal communication and coordination mechanisms		*		Informal mechanism is in place.
Institution's overall direction and coordination are provided by a central planning committee / unit.		*		Not adequately represented/established
The extent to which different units are assigned clearly defined functions		*		Only in several divisions.
Responsibilities of research / management staff are clearly identified		*		TOR/work schedule of staff not available
Effectiveness of using appropriate reporting procedures and feedback in management at different levels		*		No individual feedback procedures other than annual report

Partnership in managing of information dissemination

Table 14: Partnership in managing of information dissemination

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution systematically plans and performs dissemination of information		*		No dissemination plan for policy makers.
The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information		*		Evidence on linkages and sharing and dissemination of information among key partners.
The effectiveness of institutional procedures for technology transfer		*		Available to some extent
The effectiveness of the system to obtain feedback from different types of stakeholders			*	No feedback mechanism

Monitoring, evaluation and reporting procedures

Table 15: Monitoring, evaluation and reporting procedures

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution monitors and evaluates (M&E) its own activities periodically			*	No evidence
M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and Results).			*	No MIS available
The extent to which S& T results and other outputs are adequately reported internally (e.g. through reports, internal program reviews, seminars).		*		Project reports, research papers, maps, software available
External stakeholders contribute to the M & E process in the institution			*	No established process.
The extent to which the results of M&E are used for project/ research planning and decision-making.			*	No structured self-evaluation

Annex 7.3: Tables on Outputs during 2014. 2015 and 2016

Note: Based on the SAR, the mandate of the NRMC was categorized into 4 as listed below.

1. Research on natural resource management -RNRM
2. Technology dissemination for land and water resource development in agriculture- DLMA
3. Provide technical assistance for land and water resource development in agriculture - TLWA
4. Implementation of Soil Conservation Act – ISCA – Assessment (Soil Erosion Assessment/control/Advices/Legal actions) ISCA-FLI (Farm level implementation)
5. Maintain 28 agro-met stations island wide and provide quality controlled data to stakeholders (including research)-AGMET

The review team allocated the list of projects according to these 5 categories (RNRM, DLMA, TLWA, ISCA, AGMET) as shown in the last column of the Tables shown below.

Project outputs during 2014

Table 16: Project outputs during 2014

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
1	Forecasting Paddy Area and Yield Based on High Resolution Satellite Imageries	1. to develop digital maps of paddy cultivation areas by using on-screen digitizing with high resolution satellite imageries. 2. to develop rice extent and yield forecasting system for Sri Lanka	NARP (National Agriculture Research Program) 7,957,216.85	Continuing	TLWA
2	Assessing water Quality of major streams in central highlands of Sri Lanka	To identify critical watersheds in relation to soil erosion status.	AFACI 1,125,573.20	Research report	ISCA/Assessment
3	Assessment of soil erosion/deposition using Fallout radionuclide Techniques	To determine the soil erosion and deposition rates in central highlands in different land uses.	DOA 1,058,248.00	Continuing	ISCA/Assessment

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
4	Development, Evaluation and application of a toolkit for regional crop yield forecasting	1. to evaluate classification approaches for rapid identification and mapping of rice cultivated lands to support crop forecasting	543,141.35	Continuing	TLWA
5	Development of multi functional soil conservation bund system for rainfed upland in the dry zone.	To enhance the adoptability and to ensure sustainability soil conservation approach on rainfed upland in the dry zone by establishing multi functional earth bund system.	DOA 1,017,221.75	Continuing	ISCA/FLI
6	Digital compilation of Grama Niladari Division bases crop recommendations	to design and develop a user friendly management Information system for crop recommendation at grama Niladari Divisions level.	DOA 1,220,658.95	Continuing	TLWA
7	Drought occurrence in the DL1b agro-ecological region of Hakwatuna Oya watershed	To assess drought occurrences in DL1b agro-ecological zone	DOA 282,955.60	Research Report	AGMET
8	Enhancing soil moisture retention through land management techniques in Tea lands located in up country zone	1.Enhancing the of soil moisture	DOA 425,781.55	Conservation plan	RNRM

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
9	Evaluation of remote sensing approaches for paddy production mapping	1. To evaluate possibility of using moderate resolution satellite data for paddy land mapping 2. To develop paddy land map for Ampara district	CCAFS 512,192.15	Paddy land atlas for Ampara district developed	TLWA
10	Issuing of long-term weather forecasts at regular intervals	To provide long-term weather forecasts for agricultural sector development planning	DOA 696,648.00	Monthly weather forecasts	AGMET
11	Monitoring water quality of Mahaweli river in central highlands in Sri Lanka	1. To assess clay migration pattern from land uses in central highlands 2. To monitor the possibility of polluting stream water due to human activities in the Mahaweli upper catchments	DOA 215,613.20	Continuing	ISCA/assessment
12	Programmes under implementation of soil conservation act	1. to increase awareness of soil conservation act using different media types.	3,452,925.25	Continuing	ISCA/Advices
13	Use of Agro ecological diversity to enhance Agricultural production in Sri Lanka	1.To ensure a continuous cultivation of most important food crops in Sri Lanka by making use of the agro-ecological diversity of the country	DOSL 476,730.00	Continuing	AGMET

Project outputs during 2015

Table 17: Project outputs during 2015

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
1	Forecasting paddy extent and Yield Based on High Resolution Satellite Imageries	1. to develop digital maps of paddy cultivation areas by using on-screen digitizing with high resolution satellite imageries. 2. to develop rice extent and yield forecasting system for Sri Lanka	NARP (National Agriculture Research Program) 4859820.03	2 BSC thesis 1 paper 4 presentations 3 progress reports	TLWA
2	Agricultural land management for improving soil fertility and irrigation efficiency of agro-well based small holder farms in Sri Lanka	To provide guideline on land management for improving soil fertility and irrigation efficiency in agro-well based farms	AFACI 416724.59	Research report	TLWA
3	Assessing soil erosion status in major agricultural land uses in central highlands of Sri Lanka using isotope techniques.	1. To introduce low cost isotope (FRN) techniques for soil erosion assessment in agricultural lands	Soil conservation act) 552003.86	Continuing	ISCA/Assessment
4	Assessment of major ecosystem services in selected agricultural systems in Sri Lanka	1. To identify types of services (supporting, provisioning, regulating and cultural) and their values of agricultural land uses in selected agro-ecosystems	DOA**-BACC Project 419286.20	Continuing	RNRM
5	Development of drought monitoring and crop condition assessment system using time series satellite imageries	1. To assess drought by crop condition monitoring using time series satellite data 2. To prepare near real time drought maps covering agriculture areas	NSF 871150.66	Continuing	TLWA

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
6	Development of multi functional soil conservation bund system for rainfed upland in the dry zone.	To enhance the adoptability and to ensure sustainability soil conservation approach on rainfed upland in the dry zone by establishing multi functional earth bund system.	DOA 166429.00	Continuing	ISCA/FLI
7	Development of runoff water harvesting technology for rain-fed vegetable farming systems in the intermediate zone	1. To enhance existing vegetable production in the system through harvesting excess runoff water, storing it in the land, effective use during dry spells in the maha season or extending the season	AFAC_1 356548.63	Continuing	DLMA
8	Development, evaluation and application of a toolkit for regional crop yield forecasting and climate change impact assessment for Sri Lanka(CCAFS)	Development of a toolkit for regional forecasting and climate change impact assessment.	CCAFS 5067992.76	Research report	AGMET
9	Evaluation of land-use dynamics & trends in central highlands through time-series satellite imageries (NRMC)	1. Develop a methodology for change analysis & assess landuse/land cover changes in central highlands using MODIS satellite data 2. Characterize the types, rates, and temporal variability of change for a 15-year period	DOA 918063.40	Continuing	RNRM

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
10	Land suitability study for Sabaragamuwa Province	1. Assessment of degradation status of Sabaragamuwa Province 2. Conducting a regional scale crop suitability analysis and mapping	DOA 650831.04	Report Paper	RNRM
11	Mapping distribution probability of neglected and under-utilized fruit species in Sri Lanka using climate modelling	1. Prepare neglected fruit species (NFS) distribution maps with available tree location coordinates. 2. To locate high potential climatic areas for NFS by probability mapping	DOA 954357.37	Research Report 1 Paper	TLWA
12	Monitoring water quality of Mahaweli river in central highlands in Sri Lanka	1. To assess clay migration pattern from land uses in central highlands 2. To monitor the possibility of polluting stream water due to human activities in the Mahaweli upper catchments	DOA,BACC 787898.64	Research Report	ISCA/Assessment
13	Programmes under implementation of soil conservation act	1. to increase awareness of soil conservation act using different media types.	DOA 4950244.90	Continuing	ISCA/advice
14	Seasonal climate forecasting as a mean of adaptation to climate change and variability	2. To reduce the vulnerability of agriculture production systems under a changing and variable climate by providing long-term climate predictions with a 3 – 4 weeks lead time on AER basis, to the extent possible	DOA 1908475.57	Continuing Seasonal forecasting report	AGMET
15	Soil fertility mapping for rice lands in the low country wet zone	1. To identify soil fertility problems and their geographic spread in wet zone rice.	AFAC_2 308162.34	Research report	TLWA

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
16	Use of Agro ecological information to enhance Agricultural production in Sri Lanka	1. To ensure a continuous cultivation of most important food crops in Sri Lanka by making use of the agro-ecological diversity of the country	DOA 2146328.80	Continuing	AGMET
17	Use of Fallout Radionuclide Technique to assess the soil redistribution in different land use systems in catchment scale	1. Estimation of soil erosion and deposition rates of major agricultural land uses in representative site at Mid country wet and low country wet zone of Sri Lanka	AFACI 713762.91	Research Report Continuing	ISCA/assessment
18	Web GIS Portal for Agricultural information Dissemination	1. Provide a web-based interactive information and mapping portal for exploring data, information and maps related to Agriculture	DOA 589659.43	Continuing	DLMA

Project outputs during 2016

Table 18: Project outputs during 2016

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
1	Analytical capacity development for sustainable land management strategies	Development of physical analytical capacities of soils	743,542.28 FPNP**	Continuing	RNRM
2	Assess and map drought prone regions and characterize agro ecological environment for formulation recommendation for productivity enhancement	Drought-prone Area maps and methodology for drought-prone area assessment and mapping using time-series satellite and log-term climate data 2. Spatio- temporal database for Agricultural drought and crop condition assessment 3. Area specific and	888,229.93 FPNP, NSF	Continuing One BSc Thesis One paper	TLWA
3	Assessing soil erosion status in major agricultural land uses in central highlands of Sri Lanka using isotope techniques.	1. To introduce low cost isotope (FRN) techniques for soil erosion assessment in agricultural lands	419,417.00 FPNP	Continuing	ISCA/Assess ment
4	Assessment of major ecosystem services in selected agricultural systems in Sri Lanka	1. To identify types of services (supporting, provisioning, regulating and cultural) and their values of agricultural land uses in selected agro-ecosystems	406,431.27 BACC Project	Continuing	RNRM
5	Assessment of micro watershed based soil erosion and sedimentation in different land uses (OFC/ Vegetables/ Potato)	Assessment of catchment scale soil erosion status of major land uses in Sri Lanka	4,148,828.95 FPNP	Continuing	ISCA/Assess ment

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
6	Assessment of soil erosion hazards within declared conservation areas	Assessment of soil erosion status within the declared soil conservation areas for prioritization of conservation efforts	813,051.07 FPNP	Continuing	ISCA/Assessment
7	Assessment, characterize and mapping soil erosion hazards in dry zone	1.Drought prone area maps and methodology for drought-prone area assessment and mapping using time-series satellite and long-term climate data 2.Spatio-temporal database for agricultural drought and crop condition assessment	813,051.07 FPNP	Continuing	ISCA/Assessment
8	Crop suitability assessments and recommendations as a measure of adaptation for climate change	To develop an interactive web-based information and mapping portal for exploring and dissemination of agriculture related data , information and maps	1,274,283.96 FPNP	Continuing	DLMA
9	Development of climate smart villages as an adaptation for climate change	Demonstration of adaptation techniques for climate change through an holistic approach	961,557.57 FPNP	Continuing	AGMET
10	Development of restoration and management packages/practices for salt affected lands	Enhancing productivity of salt affected lands (uplands)through adoption of land management technologies	817,421.69 FPNP	Continuing	TLWA

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
11	Development of sustainable soil fertility management technologies (physical, chemical and biological)	Identification of physical, chemical and biological limitations in farming soils in major farming systems	866,707.34 FPNP	Continuing	RNRM
12	Evaluation and monitoring Food Production National Program through GIS approaches at GN division level	1.Prepare GN level cultivable area maps 2. produce maps to evaluate crop cultivation targets and cultivable land categories in each GN divisions. 3. Suggest recommendations for best allocation of cultivable lands for optimize GN level food pro	1,224,787.56 FPNP	Continuing Report submitted for 5 districts	TLWA
13	Evaluation of land-use dynamics & trends in central highlands through time-series satellite imageries	1. Develop a methodology for change analysis & assess land use/land cover changes in central highlands using MODIS satellite data 2. Characterize the types, rates, and temporal variability of change for a 15-year period	277,009.00 FPNP	One BSc. Thesis 2 papers	RNRM
14	Harnessing the potential of rain water harvesting to improve the land productivity under water limited situations	Enhancing the existing OFC and vegetable production in the system through harvesting excess runoff water, storing it in the land, effective use during dry spells in the Maha season or extending the season	866,528.70 FPNP	One BSc. Thesis 2 papers	DLWA

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
15	Identification of Suitable paddy lands within major irrigation schemes for seasonal crop diversification (North central Province)	1. Characterize hydrological and agro-ecological areas for diversification.	1,951,804.18 FPNP	Continuing	AGMET
16	Long-term climate forecasting and introduction & promotion of crop cultivation based on climatic predictions	To collect meteorological and crop information and issue seasonal climate forecasts with a reasonable lead time to assist agricultural planning.	1,468,592.09 FPNP	Continuing	RNRM
17	Monitoring stream water quality and identification of critical watersheds	Identification of most critical agricultural watersheds in relation to degree of soil erosion in the Mahaweli river basin.	964,266.09 FPNP	Continuing	ISCA/Assessment
18	Optimization of land and water productivity of tank cascade systems in Vavuniya district	1. Develop map of tank cascade systems in Vavuniya district. 2. Assess performance and present situation of tanks, watershed area and command area. 3. evaluate hydrological and environmental aspects for formulation of recommendation for development	634,844.73 FPNP	Continuing 2 BSc. thesis One paper	RNRM
19	Productivity enhancement of the off-season crop cultivation	To increase the agricultural productivity by harnessing the potential of agro-ecological diversity	1,101,890.52 FPNP	Continuing	TLWA
20	Programmes under implementation of soil conservation act	1. to increase awareness of soil conservation act using different media types.	5,067,724.89 FPNP	Continuing	ICSA/Advice

#	TITLE	OBJECTIVES	Budget* & Funding source	Outputs	Mandate
21	Updating of erosivity map of Sri Lanka with response to climate change	To Identify the anomalies in Rainfall intensities in Sri Lanka to revitalize rainfall erosivity map	1,170,404.91 FPNP	Continuing	RNRM
22	Water balance studies in dry zone micro watersheds to develop shallow ground water availability regions	To identify safe limits of shallow ground water extraction	808,116.85 FPNP	Continuing	TLWA
23	Web GIS Portal for Agricultural information Dissemination	1. Provide a web-based interactive information and mapping portal for exploring data, information and maps related to Agriculture	459,675.90 FPNP	Continuing	DLWA

* Budget component based on CARP INFORM data and in include research staff and admin cost

** FPNP - Food Production National Program

Annex 7.4: Results of SWOT analysis reference to the institution

Strengths of the institute in achieving the vision

- Well established reputation with other organizations dealing with NRM
- Well qualified staff available
- Well established collaboration with relevant Organizations
- Fairly organized infrastructure facilities
- Recently acquired research and demonstration facilities
- Vested with a legal provisions for implementation of Soil Conservation act on behalf of DGA

Weaknesses of the institute in achieving the vision

- No regional institutional network
- Not assisted by a legal arm
- Unavailability of need based, well-focused training programs for update of knowledge & skills
- Inadequate legal provisions in the present SC act
- Inadequate promotion of NRM issues within the DOA
- Office space limitations

Opportunities to the institute

- NRM is one of the high priority area in local and international arena
- More opportunities to collaborate with local and international agencies since the inter-sectoral nature of the subject

- Wide spectrum of working platform
- Ability to use available global information for NRM research and development for the betterment of agriculture in Sri Lanka

Threats to the institute

- Within a very short time span experienced staff will be retiring (Senior & middle level)
- Haphazard development planning & implementation
- Lack of consistent financial support
- Reluctance of implementation of SLM related activities in farmlands due to high cost & lack of short term benefits
- Land & water management research are long-term in nature, thus their practical implementation is a massive involvement with outside parties