GHG Appraisal of Coastal Resources for Sustainable Development Project (CRSD)

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Introduction

This report provides the results of an Ex-Ante Carbon-balance Tool (EX-ACT) Greenhouse Gas (GHG) appraisal of the Coastal Resources for Sustainable Development Project (CRSD) carried out by the CRSD team during the EX-ACT workshop organized by FAO and World Bank from 14 to 17 June 2016 in Hanoi.

The EX-ACT is an appraisal system developed by FAO providing ex-ante estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon-balance.

Project Context

The co-existence of rapid growth and high vulnerability applies to Viet Nam's fisheries sector, including both marine fisheries and aquaculture. The sector has experienced very rapid growth over the past two decades. Viet Nam ranks third in world aquaculture production (behind China and India) and sixth in terms of aquatic product exports. Domestic consumption is also growing rapidly, with the Vietnamese now obtaining nearly 50 percent of their dietary protein from aquatic products. Despite such growth and increased socio-economic importance, the Vietnamese fisheries sector is at risk, due to a depleting resource base for marine fisheries, increasing environmental and disease problems in aquaculture, as well as associated financial difficulties experienced by large numbers of sectoral participants.

There are evident signs that the past growth of the country's marine capture fisheries is non-sustainable. Volume growth has nearly halted in recent years, except with respect to lesser value fish species. Productivity is declining and the share of „trash fish" and small-sized fish in the landed catch is increasing. Overfishing is especially evident in the nearshore areas, which are the fishing grounds for some 85 percent of the country's fleet and the primary source of livelihood for most poor or near poor coastal communities.

Regarding aquaculture production systems, it is increasingly challenging to sustain production levels due to increased risks of disease and environmental pollution. The sub-sector's growth has been phenomenal,

especially over the past decade. In 2008, Viet Nam accounted for almost 5 percent of global aquaculture output - more than triple its share from a decade earlier. Disease is now the major production risk; there are also potential problems in sourcing high quality seed and broodstock. The expansion of aquaculture has also contributed to environmental damage and water pollution.

Project Description

The CRSD is operational from 2012-2018 and is implemented by the Ministry of Agriculture and Rural Development (MARD) in eight project provinces (Thanh Hoa, Nghe An, Ha Tinh, Binh Dinh, Phu Yen, Khanh Hoa, Soc Trang and Ca Mau). Supporting agencies and institutes include besides others the Agricultural Projects Management Board (APMB), Department of Aquaculture (DOA), Department of Capture Fisheries & Resources Protection (DECAFIREP), Viet Nam Administration of Seas and Islands (VASI), Research Institutes for Aquaculture (RIAs), and the provincial Departments of Agriculture and Rural Development (DARD), Natural Resources and Environment (DONRE), and Animal Health (DAH). Total project costs amount to USD117.9 million, of which USD100.0 million are financed by the World Bank.

The CRSD will improve the sustainable management of coastal fisheries in the Project Provinces. The project will directly benefit 50,000 smallholder aquaculture farm and fisher folk households in the project area, whose lives are dependent on the sustainable use of coastal resources. Ethnic minorities, including the Khmer living in Soc Trang province, will also benefit. Other beneficiaries will be people employed in other segments of the aquaculture/fisheries value chains.

The key project result indicators are:

- Indicator 1: Increase in the proportion of farms meeting national standards for water effluent following the adoption of Good Aquaculture Practices.
- Indicator 2: Reduction in shrimp disease losses in the production areas applying Good Aquaculture Practices.
- Indicator 3: Increase in the proportion of areas in which sustainable Near-Shore fisheries resource management systems are applied.

The project is constituted by the four project components: (A) institutional capacity strengthening for sustainable fisheries management; (B) good practices for sustainable aquaculture; (C) sustainable management of near-shore capture fisheries; and (D) project management, monitoring and evaluation. The project components are depicted in the following in more detail.

- **Component A: Institutional capacity strengthening for sustainable fisheries management**
  This component supports three activities: (a) inter-sectoral spatial planning for coastal areas; (b) upgrading of Viet Nam fisheries database; and (c) conducting selected policy research.

- **Component B: Good practices for sustainable aquaculture**
  This component supports good aquaculture practices through: (a) improved bio-security management; (b) improved seed quality management; and (c) improved environmental management.

- **Component C: Sustainable management of near-shore capture fisheries**
  This component supports: (a) co-management of near-shore capture fisheries; and (b) rehabilitation of fishing ports and landing sites.

As a consequence of these activities the project aims at increasing the sustainability of near-shore fisheries in Viet Nam and building a solid basis for highly productive, resilient and sustainable aquaculture production systems.

Project Data Used

The EX-ACT GHG assessment of CRSD is carried out for tropical moist climate conditions and a dominant soil type of Low Activity Clay (LAC) soils. Project impacts are estimated during a total period of 20 years after project start, considering a six-year period for project implementation and 14 years for capitalization.

At this stage of project implementation, project impacts are mainly foreseen in the areas of (i) rehabilitation of seagrass meadow, (ii) reduced consumption of agricultural inputs, (iii) reductions in offshore fisheries, and (iv) sustainable intensification of aquaculture production.

- **Rehabilitating seagrass meadow**

As a consequence of project implementation it is estimated that 83,000 hectares of seagrass meadow are restored from a state of degradation of 50 percent lost biomass to 30 percent lost biomass.

The table below identifies total GHG mitigation benefits of 444,936 tCO_2 equivalent (tCO_2e) over 20 years follow from rehabilitating the estimated area of seagrass meadows. This is equivalent to annual GHG mitigation benefits of 22,247 tCO_2e.

Table: GHG impacts from rehabilitation of seagrass meadow

6.1.3. Rewetting

Type of vegetation	Area rewetted (ha) Start	Without		With		Without	With	Total Emissions (tCO2-eq) Without	With	Balance
Mangrove	0	0	D	0	D	0%	50%	0	0	0
Tidal marsh	0	0	D	0	D	0%	50%	0	0	0
Seagrass meadow	83000	83000	D	83000	D	50%	70%	-1,504,928	-1,949,864	-444,935
								-1,504,928	**-1,949,864**	**-444,935**

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- **Reduced consumption of agricultural inputs**

The project estimates that the average annual consumption of limestone, urea and fungicides will decrease by 30 percent due to more sustainable practices of aquaculture production.

Due to the decreased resource use, associated GHG emissions from input production and application will decrease annually by 9,572 tCO_2e. This is equivalent to total GHG mitigation benefits of 191,439 tCO_2e over 20 years (see below).

Table: GHG impacts from reduced consumption of agricultural inputs

6.1. Inputs (liming, fertilizers, pesticides, herbicides,...)

Description and unit to report	Amount applied per year					Total emissions at field level (tCO2-eq)				Emissions from production, transportation, storage and transfer (tCO2-eq)		Total Emissions (tCO2-eq)		Balance
						CO2 emissions		N2O emissions						
Lime application	Start	Without	*	With	*	Without	With	Without	With	Without	With	Without	With	
Limestone (tonnes per year)	2,400	2,400	D	1,680	D	21,120	15,734	-	-	28,160	20,979	49,280	36,714	-12,566
Dolomite tonnes per year)	0	0	D	0	D	0	0	-	-	0	0	0	0	0
not-specified (tonnes per year)	0	0	D	0	D	0	0	-	-	0	0	0	0	0
Fertilizers												0	0	0
Urea (tonnes of N per year - Urea has 46.7% of N)	51	51	D	0	D	1,613	242	4,808	721	4,894	734	11,315	1,697	-9,618
Other N-fertilizers (tonnes of N per year)	0	0	D	36	D	-	-	0	2,863	0	2,914	0	5,777	5,777
N-fertilizer in irrigated rice (tonnes of N per year)	0	0	D	0	D	-	-	0	0	0	0	0	0	0
Sewage (tonnes of N per year)	0	0	D	0	D	-	-	0	0	-	-	0	0	0
Compost (tonnes of N per year)	0	0	D	0	D	-	-	0	0	-	-	0	0	0
Phosphorus (tonnes of P2O5 per year)	0	0	D	0	D	-	-	-	-	0	0	0	0	0
Potassium (tonnes of K2O per year)	0	0	D	0	D	-	-	-	-	0	0	0	0	0
Pesticides														
Herbicides (tonnes of active ingredient per year)	0	0	D	0	D	-	-	-	-	0	0	0	0	0
Insecticides (tonnes of active ingredient per year)	0	0	D	0	D	-	-	-	-	0	0	0	0	0
Fungicides (tonnes of active ingredient per year)	2,400	2,400	D	1,680	D	-	-	-	-	686,400	511,368	686,400	511,368	-175,032
												Total Inputs	746,995	555,555	-191,439

* Note concerning dynamics of change : "D" corresponds to default/linear, "I" to immediate and "E" to exponential (Please refer to the guidelines)

Tier 2

As a consequence of measures to use energy efficiency in aquaculture systems, it was further estimated by the project staff that electricity consumption will decrease by 30 percent and gasoil consumption by 10 percent.

The reduced consumption of electricity and fuels leads to reductions in GHG emissions by 27,743 tCO_2e per year (or 554,879 tCO_2e over 20 years).

Table: GHG impacts from reduced consumption of electricity and fuels

6.2. Energy consumption (electricity, fuel,...)

Description and unit to report	Quantity consumed per year					Total Emissions (tCO2-eq)		Balance
	Start	Without	*	With	*	Without	With	
Electricity (MWh per year)								
Vietnam	141750	141750	D	99225	D	1,301,839	969,870	-331,969
(please select the country of origin)								
Liquide or gaseous (in m3 per year)								
Gasoil/Diesel	50000	50000	D	45000	D	2,622,470	2,399,560	-222,910
						3,924,309	3,369,430	-554,879

Tier 2

- **Reduced fishing volume of near-shore fisheries**

As a result of livelihood diversification measures and improved income potential form aquaculture production, it is expected that the volume of near-shore fisheries will reduce by 10 percent as compared to the business-as-usual situation.

The table below identifies that due to the 10% reduction in fishing volume, annual GHG emissions are expected to reduce by 15,687 tCO_2e (or 313,739 tCO_2e over a 20-year period).

Table: GHG impacts from reduced near-shore fisheries

8.1. Fisheries

The sections 6.1 (Inputs), 6.2. (Energy) and 6.3. (Construction of new infratructure) can be used to complement this section

Fishing operations (based on Fuel Use intensity - FUI - values)							Total Emissions		Balance
Category	Gear	Total catch per year (tonnes per year)					(tCO2-eq)		
		Start	Without	*	With	*	Without	With	
Crustaceans	Gillnets	7500	7500	D	6750	D	247823	226758	-21065
Finfish	Gillnets	122500	122500	D	110250	D	4130023	3778971	-351052
Not Specified	Not specified	0	0	D	0	D	0	0	0
Not Specified	Not specified	0	0	D	0	D	0	0	0
Not Specified	Not specified	0	0	D	0	D	0	0	0

On-board leakage from refrigeration systems	Start	Without	With	Without	With	
Total catch with refrigerant systems (fishes, etc.)	0	0	0	0	0	0
Emissions from production of ice produced ashor	Start	Without	With	Without	With	
Total artisanal and coastal catch	65000	65000	105300	110775	169153	58378

Tier 2

Total from catch	4488621	4174882	-313739

- **Sustainable intensification of aquaculture production**

Aquaculture production is foreseen to be sustainably intensified in order to provide alternative revenue potentials to beneficiaries that do not harm the regeneration of near-shore fish stocks. While fish production will increase as well as associated GHG emissions from excretion of ammonia, feed consumption will be reduced by 10 percent as a measure to reverse too high feeding rates in current systems.

The table below identifies that GHG emissions from aquaculture ponds increase by an estimated 2,691 tCO_2e per year (or 53,815 tCO_2e over a 20-year period).

The GHG reduction from reduced feed usage can currently not be estimated in the absence of a country specific GHG emissions factor for feed production in Viet Nam.

Table: GHG impacts from changes in aquaculture management

8.2. Aquaculture

The sections 6.1 (Inputs), 6.2. (Energy) and 6.3. (Construction of new infratructure) can be used to complement this sectio

Aquaculture (only emissions from N2O during fish production)		Annual production (tonnes per year)					Total Emissions (tCO2-eq)		Balance
		Start	Without		With		Without	With	
Production system 1	Whiteleg Shrimp	31500	31,500	D	35,000	D	498584	545672	47088
Production system 2	Tiger Shrimp	3600	3,600	D	4000	D	56981	62363	5382
Production system 3	Crab	900	900	D	1000	D	14245	15591	1345
Production system 4	description 4	0	0	D	0	D	0	0	0
Production system 5	description 5	0	0	D	0	D	0	0	0
		Annual quantity of feeds (tonnes per year)							
Emissions from feeds		Start	Without		With		Without	With	
Feed n°1	Concentrate	49500	49500	D	39600	D	0	0	0
Feed n°2	description 2	0	0	D	0	D	0	0	0
Feed n°3	description 3	0	0	D	0	D	0	0	0
Feed n°4	description 4	0	0	D	0	D	0	0	0
Feed n°5	description 5	0	0	D	0	D	0	0	0
							Total aquaculture	569810	623625	53815

Tier 2

Project GHG Appraisal Results

As a combination of the joined project impacts identified above, CRSD provides annual GHG benefits of 72,555 tCO_2e.

Over the full analysis period of 20 years a total of 1.5 million tCO_2e are mitigated. 30 percent of these mitigation benefits are due to increased carbon stocks, while 70 percent are due to reduced GHG emissions.

The table below shows that the reduction in agricultural input and energy use contribute 51 percent of the overall mitigation benefits. The restoration of seagrass meadow contributes 31 percent, while the combined impact of reducing off-shore fisheries and increasing aquaculture production contributes 18 percent to the overall mitigation benefits.

Table: Overall project GHG assessment

Components of the project	Gross fluxes Without	With	Balance
	All GHG in tCO2eq		
	Positive = source / negative = sink		
Land use changes			
Deforestation	0	0	0
Afforestation	0	0	0
Other LUC	0	0	0
Agriculture			
Annual	0	0	0
Perennial	0	0	0
Rice	0	0	0
Grassland & Livestocks			
Grassland	0	0	0
Livestocks	0	0	0
Degradation & Management	0	0	0
Coastal wetlands	-1,112,338	-1,557,274	-444,935
Inputs & Investments	4,671,222	3,924,980	-746,243
Fishery & Aquaculture	5,058,431	4,798,507	-259,923
Total	8,617,315	7,166,214	**-1,451,101**
Per hectare	104	86	-17
Per hectare per year	5.2	4.3	-0.9

Discussion and Recommendations

The CRSD provides low to moderate GHG mitigation benefits. The introduction of more sustainable aquaculture production systems allows to reduce GHG emissions per quantity of aquaculture output produced, due to lower feeding rates and reduced input consumption.

Relevant monitoring variables during project implementation are: (i) actual quantities of fish captured in near-shore areas; (ii) energy and input consumption in aquaculture systems; and (iii) aquaculture stocking and feeding rates.

With regard to the rehabilitation of seagrass meadow, a separate monitoring of the actual rehabilitation impact achieved would likewise lead to an increase in the certainty of GHG assessment results.