MEKONG DETA SITUATION ANALYSIS

INTRODUCTION

This paper is the result of the 1-day roundtable discussion taking place on December 8th, 2010, commissioned by IUCN Vietnam, among a multidisciplinary group of experts with long-term and in-depth knowledge of the Mekong Delta. The discussion sought to analyze the situation of the Mekong Delta through examining past trends of the key sectors including soil, water, wetlands, farming systems, and socio-economics, the drivers behind the trends; assess external threats in store for the delta and opportunities that are likely to affect the sustainability of its development; project the trends into the future; identify issues that need to be addressed; and provide recommendations for addressing the issues.

The team of experts included: Dr. Duong Van Ni, Team Leader--Socio-economics; Dr. Le Anh Tuan--Water resources; Dr. Nguyen Duy Can—Farming System; Dr. Le Phat Quoi—Soil Science; Dr. Nguyen Huu Thien—Wetlands (report writer).

Figure 1: location of the Mekong Delta

BACKGROUND

At an average elevation of 1.5 meter a.m.s.l, the Mekong Delta is a vast wetland of 40,604.7 km^2, accounting for 12% of the area of Vietnam. The Delta is home to 18 million people or 20% of the country's population.

It plays an important role in food security and the economy of the country by contributing 50% of the country's agricultural production, 50% of rice, 60% of fruit, 65% of seafood products. As the Delta has been built by the accumulation of sediment from the Mekong River and depends on the River for water; the culture, lifestyle and farming practices of the Delta are based on the water system.

Figure 3: The Mekong Delta

The key wetland types found in the delta include inland freshwater, coastal wetland, estuary, and peatland wetlands.

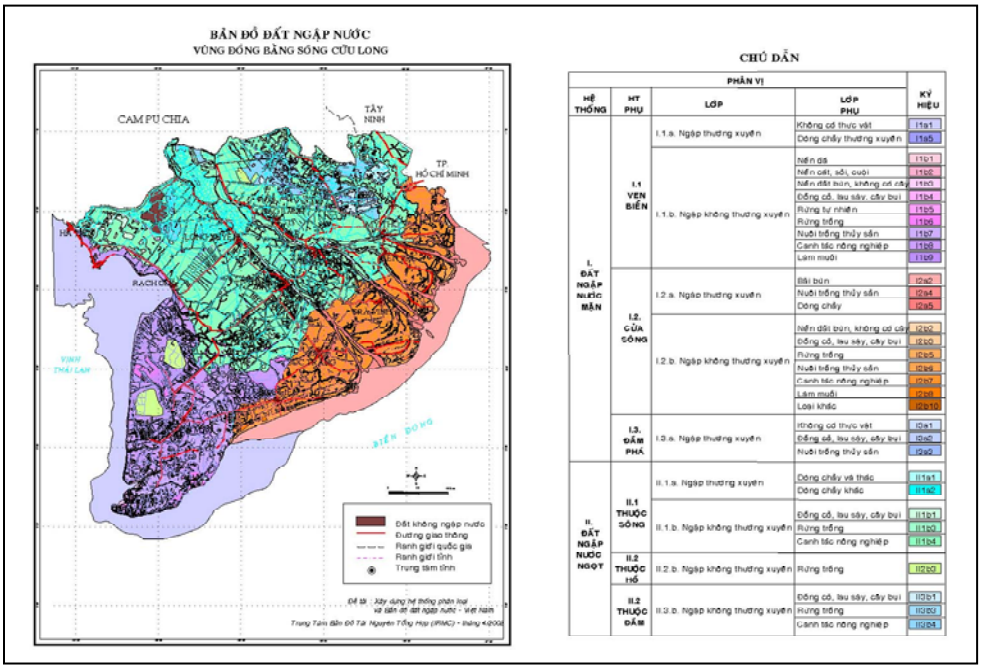


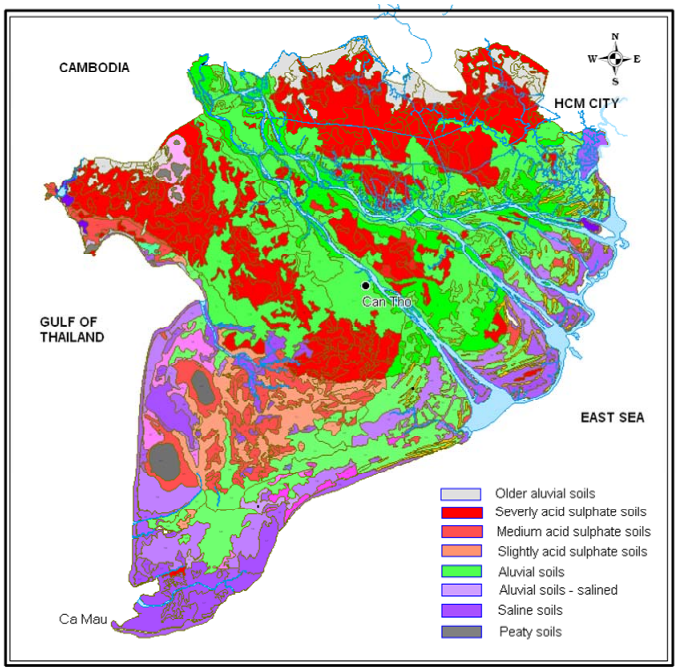
Figure 3: Main wetland types of the Mekong Delta

The delta can be classified into 6 main zones including: i) freshwater alluvial zone (FAZ); ii) Plain of Reeds Zone (PRZ); iii) Long Xuyen Quadrangle Zone (LQZ); iv) Trans-Bassac Zone (TBZ); v) Coastal Zone (CZ); vi) Ca Mau Peninsular Zone (CPZ) as shown in Figure 4.

Figure 4: The 6 Ecological Sub-Zones of the Delta.

In terms of soils, the delta can be divided into: (a) Terrace of older alluvial land

Flood plains (b) Fresh floodplain (c) Acidic floodplain, (d) Estuary (e) Saline coastal zone.



- About one million of hectare is acid sulphate soil.
- Difficult for agricultural production
- Degraded Grey Soils with very low fertile resulting in low rice yield.

Figure 5: Soil map of the Mekong Delta

Socio-economically, the delta can be divided into 3 main areas:

Rural area

This area accounts for 83% of the land area of the Delta and is home to 70% (13 million) of its population. All agricultural food production takes place in this area.

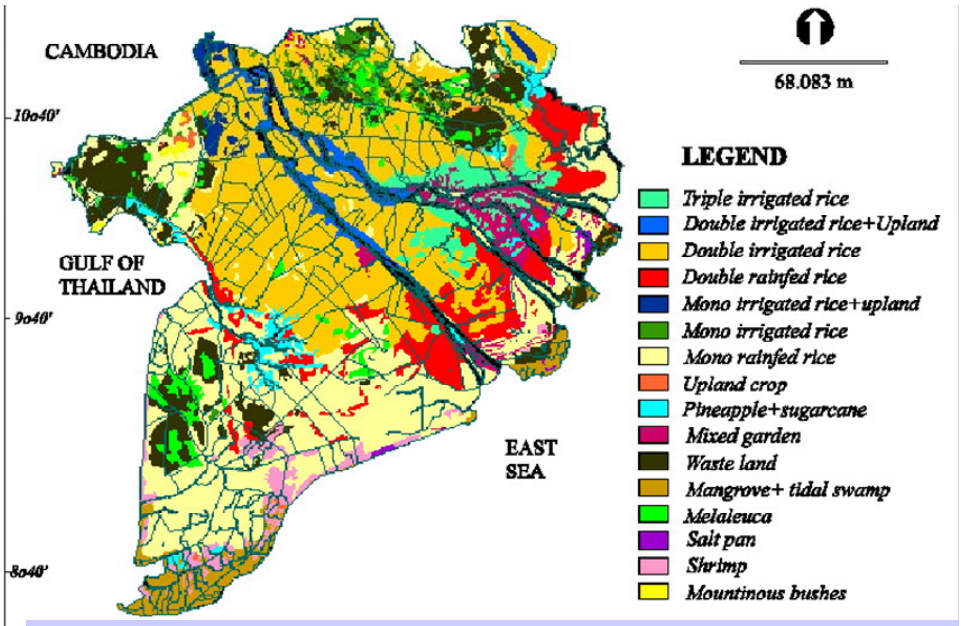
Urban area:

This area of 4,000km^2 or approximately 10% of the land area of the delta is home to 30% of the population or about 5 million people. Almost 100% of the industrial production of the delta takes place in this area.

Protected forest/wetland area

Protected forests/wetlands in the delta totaled 2,800 km^2 or 7% of the land area. All forests in this area are replanted forests. Biodiversity hotspots are housed in these remaining scattered protected areas.

Land uses often depend on topography, soil characters, hydrology, infrastructures, economy and policies. The main land uses found in the delta include (i) triple irrigated rice, (ii) double irrigated rice and upland crops, (iii) double irrigated rice, double rainfed rice, (iv) mono irrigated rice and upland crops, (v) mono rainfed rice, upland crops, (vi) pineapple and sugarcane, (vii) mixed garden, (viii) mangrove and tidal swamp, (ix) melaleuca forest and plantation, (x) salt pan, (xi) shrimp pond, (xii) fish aquaculture, (xiii) mountainous shrub.



Land uses often depends on: Topography, soil characters, hydrology, infrastructures, economy and policies.

Figure 6: Land uses in the Mekong Delta

PAST TRENDS

This section will look at the key trends taking place in the delta over the past 30 years and examine the drivers behind those trends.

Trend #1: Rapid GDP growth and Poverty Reduction

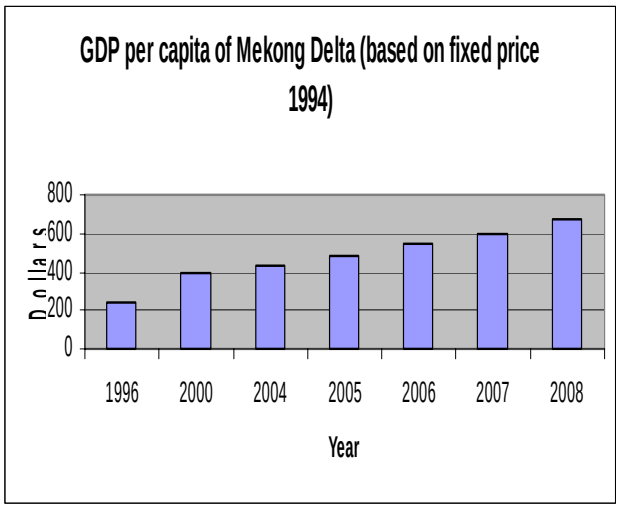


Figure 7: GDP per capita trend of the Mekong Delta

Similar to the country as a whole, the Mekong Delta has witnessed a trend of rapid growth of both total GDP and GDP per capita, a trend which was strongest during the 1991-1995 period. The drivers of this rapid trend were:

- The shift from a centrally planned to a market oriented economy.
- Various laws were passed (Enterprise Law, Foreign Investment Law, Land Law, and that The 1992 Constitution recognizes a multi-element economy).
- The rapid increase in investment capital

- The rapid increase of FDI.

For the Mekong Delta, perhaps the most important driver of the growth was the expansion and intensification of agriculture and aquaculture.

In line with the rapid growth of GDP is the rapid trend of poverty reduction. Data showing these trends are shown in the graphs in Figures 7,8, and 9.

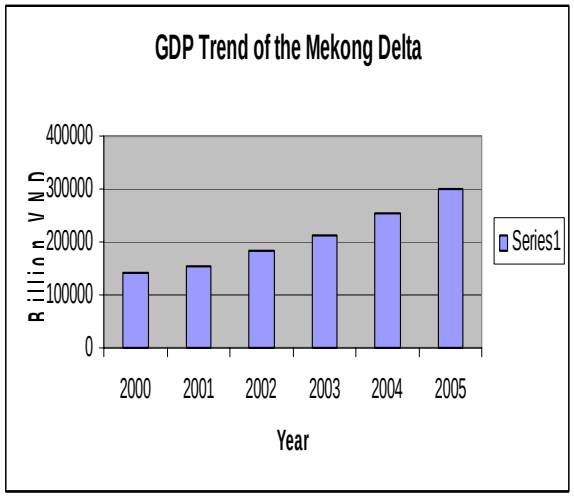


Figure 8: Trend of total GDP

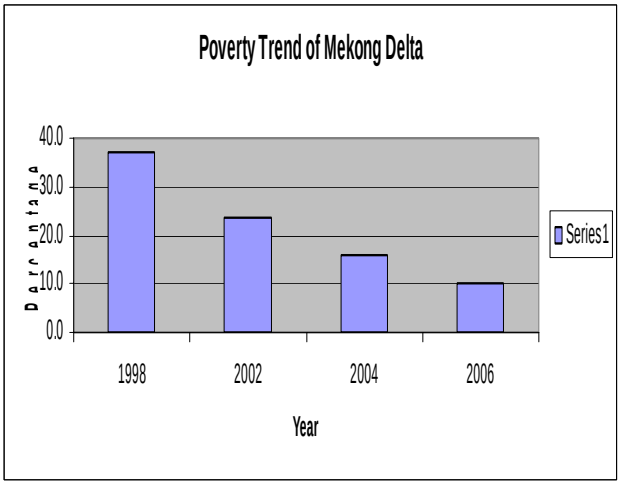


Figure 9: Poverty reduction, trend of the MD

Trend #2: Cereal production has reached its plateau

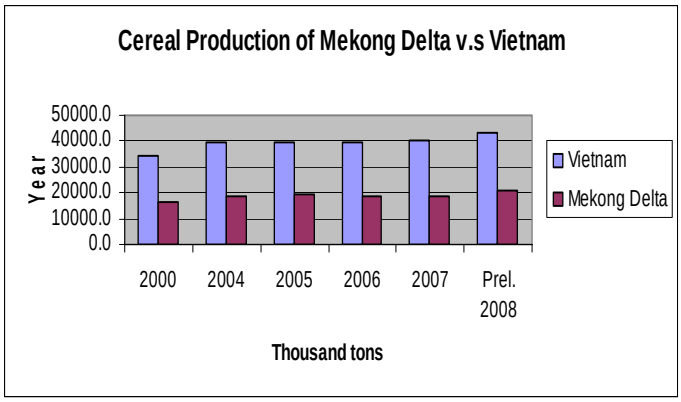


Figure 10: Cereal production trend

The expansion and intensification of agriculture and aquaculture, which contributed significantly to the rapid growth of GDP and poverty reduction trends, however, seems to have reached its plateau for practical reasons— e.g. no more land exists for expansion. Most of the land suitable for agriculture is already heavily used for agriculture purposes.

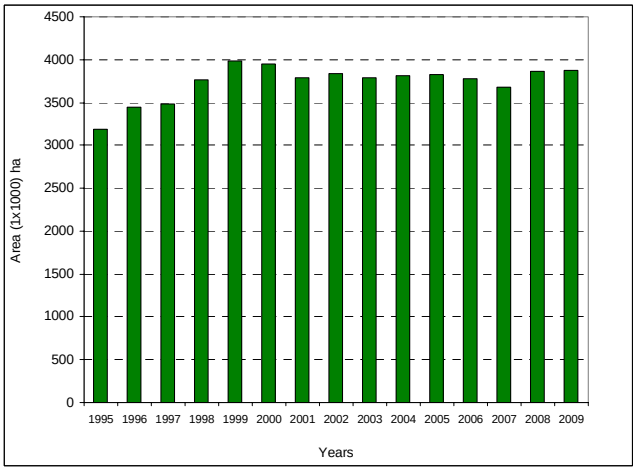
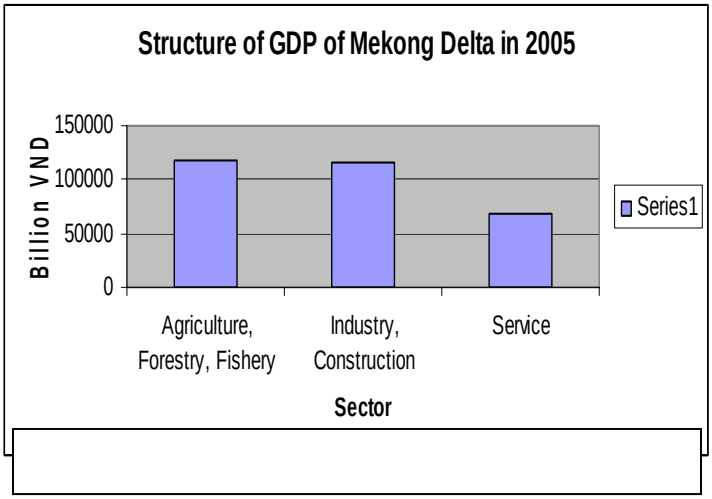


Figure 11: Cultivated area from 1995-2009

Trend #3: A shift of GDP composition toward industry



Given that agriculture expansion and intensification have reached their limits. The GDP composition of the Delta seems to have shifted toward industry in line with the similar trend for the country as a whole. However, it should be noted that the "industry" sector in the Mekong Delta comprises mostly agriculture and aquaculture ancillary industries—food and fishery processing, transporting, trading, and associated services. So the industry sector of the Mekong Delta is dependant on agriculture and fisheries. It can be said that agriculture and fisheries are the 2 "economic pillars" of the delta as it has no other significant potentials such as mineral mining, timber, and (qualified) human resources.

Trend # 4: Physical changes:

With the expansion of agriculture, most of the land area of the delta has been heavily used for agriculture and a small remaining amount is used for forestry/wetland conservation purposes. The physical conditions have been changed significantly through a dense network of canals enabling freshwater delivery to most parts of the delta. Through this canal system, water has been used for flushing out soil toxicants and acidity.

Due to heavy uses of the land and insufficient supply of nutrients, changes to the soil features of the delta have been observed as in the following Table:

Table 1: Trend of changes soil features in the Delta during the past 30 years

Before	Present
Grey soil	Degraded grey soil
Medium acid sulphate soil	Alluvial soil or alluvial soil poor in nutrients
Potential acid sulphate soil	Alluvial soil on actual acid sulphate soil and actual acid sulphate soil
Soil affected by salinity	Alluvial soil on saline soil
Saline soil	Alluvial saline soil

Area of degraded grey soil has been increased while area of acidic soil has been reduced. Area of saline soil was reduced at first for 2 decades but after that increased again recently due to the weak flows coming from upstream Mekong during the dry season.

In the past 2 decades, many flood control dykes have been built, especially in An Giang and Dong Thap province to enable intensive rice farming. Studies (Duong Van Nha, 2008) have shown that rice yields within dykes have started falling over the year due to the shortage of nutrient supply from sediment. Duong Van Nha (2008) found that in An Giang province, rice productivity outside dykes (polder) has remained stable at 5.86-6.74 tons/ha while that inside the dykes only reached 5.28 tons/ha at maximum although fertilizer application inside dykes is higher than that outside the dyke by 131-134 kg/ha.

Table 2 below shows the reduction of rice yield inside dykes over the years after the completion of the dykes. The general trend is that the longer the time, the more the reduction of rice yield.

Table 2: Reduction of rice yield within dykes over time

Number of years after completion of dykes	Reduction of rice yield in Winter-Spring Rice Crop	Reduction of rice yield in Summer-Autumn Rice Crop
2	-0.71 tons/ha	-0.32 tons/ha
4	-0.109 tons/ha	-0.34 tons/ha
6	-0.109 tons/ha	-0.39tons/ha

Trend #5: Farming system changes

In terms of the farming system, after 1975 the delta witnessed a rapid increase of rice farming area and a rapid shift from traditional farming to intensive rice farming during the 1980-1990s. Market oriented rice production started in 2000.

Trend #6: Declining water resources

Water resources of the delta are on a declining trend. Recent observed trends can be summarized as follows:

1. Reduced water volume

The volume of flood water coming to the delta has been lessened. The peak flood level observed in Chau Doc station in 2010 was the lowest in 85 years.

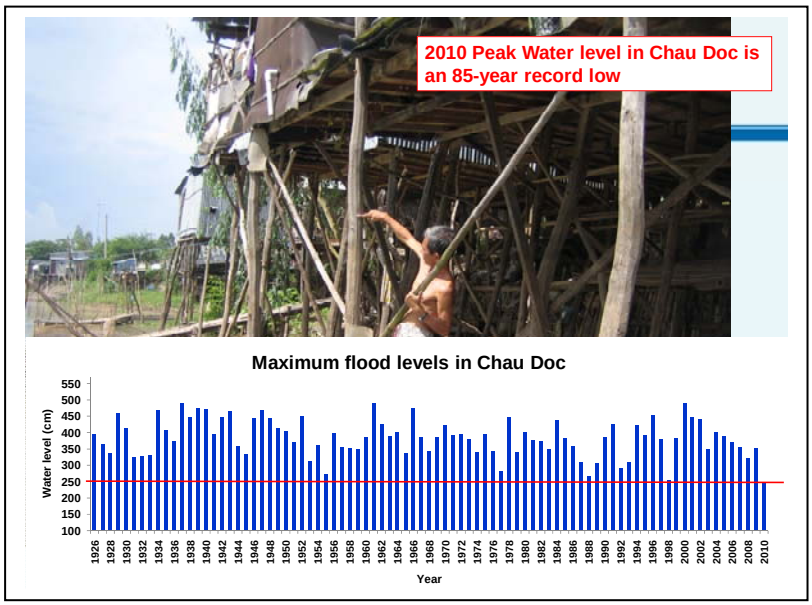


Figure 12: 2010 Peak flood water in Chau Doc is an 85-year record low

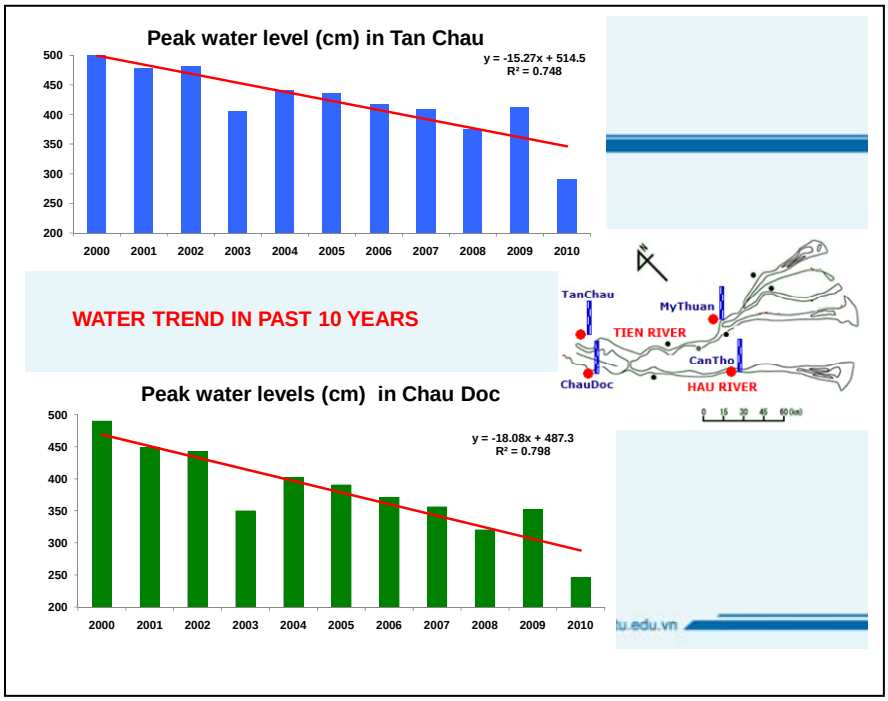


Figure 13: Reducing Trend of Water during past 10 years

Dry season flows have also been weakened. Consequently, saline intrusion in the dry season has been further inland.

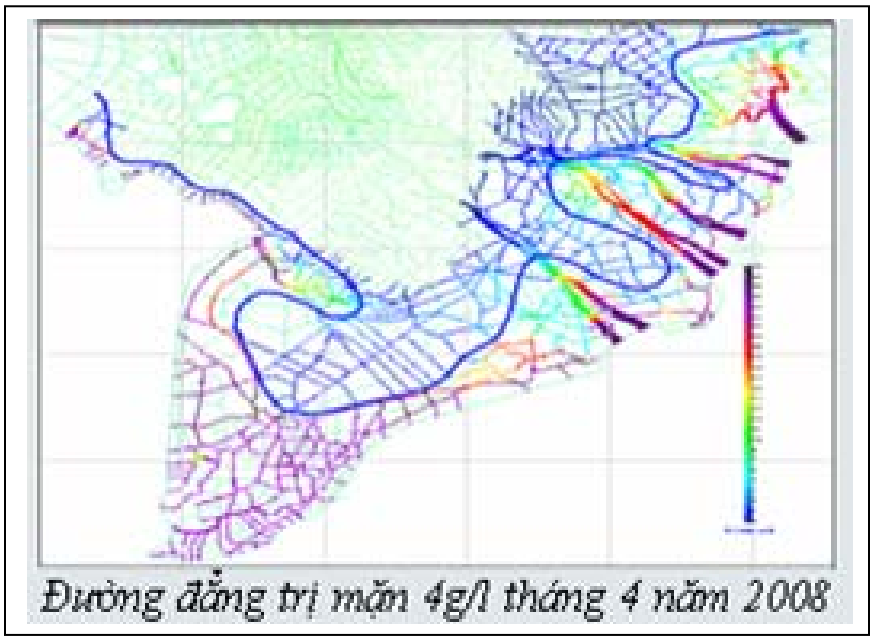


Figure 14: 2008 Salinity contour (VAWE, 2009).
Notes: in April 2010, salinity of 1g/L was recorded in Can Tho, 70km in land.

2. Reduced water quality

So far, water content (g/m^3) has not changed significantly, but total sediment load coming to the delta has been reduced due to the reduction of water volume passing through the delta. Water has become more polluted with waste from urban areas.

3. *Water seasonality has also changed*

The flood season starts later than before and floods also come unexpectedly at the tail end of the flood season.

Trend #7: Declining fisheries resources

There is strong relationship between peak water levels and production of wild fishery. As a result of the decline of water levels and also partly due to overexploitation and other causes, the wild caught fishery resource has declined.

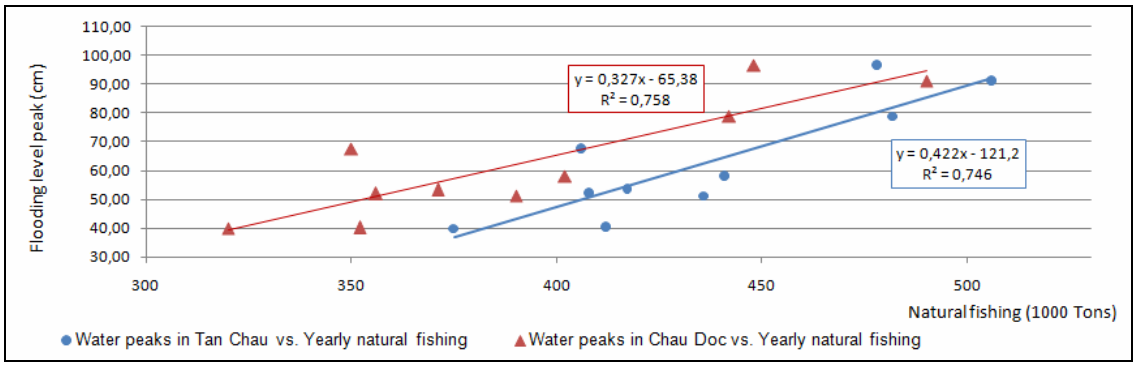


Figure 15: The relationship between productivity of wild caught fish and peak water levels is very strong (R2=0.75)

Trend #8: Loss of natural habitats and declining ecosystem integrity

During the past 30 years, many mangrove areas have been converted to aquaculture, mainly for raising shrimp. Most of the natural melaleuca and grassland areas have been converted either to rice agriculture or replaced with planted maleleuca. Scattered protected areas have been established at biodiversity hotpots. While natural habitats outside these protected areas have almost totally disappeared due to the expansion of agriculture and aquaculture, the habitats inside the protected areas are semi-natural.

Wetland habitat quality has also declined. This is mainly due to poor management of hydrology regimes that created and support the seasonally inundated wetland ecocosystems in the Mekong Delta.

Trend #9: Decline of peat area and quality

Peatland is mainly distributed in the U Minh region and includes both U Minh Thuong and U Minh Ha areas. In 1962, total peat area of U Minh was about 90,000 ha. At present, only about 12,000 ha remains in U Minh Ha National Park and U Minh Thuong National Park and their buffer zones.

Depths of the peat layers have also been significantly reduced due to poor management practices which resulted in peat fires and oxidation.

Trend #10: Wetland conservation policies in place

Before, wetlands were usually referred to as wasteland that needed to be cleared for production. Since 2003, the term “wetland” appeared for the first time in Decision 109 of the Prime Minister which mandates conservation of important wetlands. The Decision 186 (2006) also provided that wetland hydrology must be managed appropriately to the needs of wetland ecosystems. This is a significant step forward in the legislation relating to wetland conservation. Recently in 2009, the Biodiversity Law was enacted.

Trend #11: Climate Change:

Farmers in the Mekong Delta have reported that they have acutely felt the following phenomena during the past 4 years, especially in the past 2 years:

- Higher sea levels.

- Saline intrusion further inland
- A shorter rainy season
- Longer dry season
- More intense and less predictable rain events
- Higher temperatures, especially during the dry season.

Trend #12: Urbanization

Urbanization in the delta is also rapidly taking place. On October 9, 2010, the Prime Minister signed Decision 1581/QD-TTg approving the construction planning scheme of the Mekong Delta to 2020 with a vision to 2050. One of the objectives of the planning scheme is "by 2050, the Mekong Delta will be a large agriculture production area within the global production network". According to the scheme, the population of the delta is projected to be 20-21 million people in 2020, of which 7-7.5 million will be urban dwellers at an urbanization rate of 33-35%; and by 2050 a total of 30-32 million people, 25-27 million people will be urban inhabitants at an urbanization rate of 40-50%.

Trend #13: Development challenges have emerged.

With the expansion of agriculture and agriculture, GDP of the Mekong Delta has increased over the past 20 years.

However, new development challenges have emerged, including (i) social inequity, (ii) migration from rural to urban areas, (iii) epidemic outbreaks, (iv) loss of cultural values.

Farmers in the Delta can be categorized into 3 groups: (i) a landless group; (ii) a self-sufficient group and (iii) surplus generating group. The landless is the most vulnerable group. They sell agricultural labor to group (iii) and to a certain extent to group (ii) and buy food from group (iii).

Trend #14: Migration of the young to the cities and turning to natural resources as survival strategies.

As mentioned above, rural group iii provides agriculture employment and sell foods to group i. However, selling agriculture labor does not help get group (i) out of poverty.

A noteworthy trend that can be observed clearly in the rural villages across the Mekong Delta is the absence of people below 40 years of age. Most of the young people in rural villages have migrated to the big cities to work in industrial zones. However, being poorly equipped with a low education level and technical skills, the rural young oftentimes end up selling their simple labor and fetch low incomes. Their remittances back home are, hence, low and do not help to get their families out of poverty.

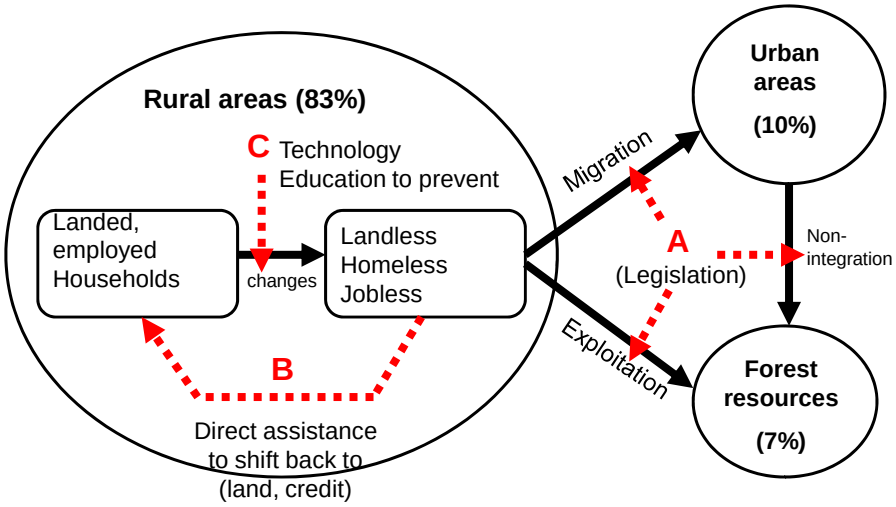


Figure 16: Survival strategies of the Landless rural group—Group (i)

Those in group (i) that stay at home in the villages are above 40 years of age. Besides, selling agriculture labor to group (iii) and doing small scale animal husbandry around the house, they turn to natural resources, mostly edible wild vegetables, fuel wood, and fisheries in the semi-natural areas that remain in the protected areas, rivers, and canals.

With fishery resources dwindling due to the declining water resources and over-exploitation, this livelihood strategy is becoming less and less viable. At the same time, the exploitation of natural resources as a survival strategy of the landless and poor group also presented a great challenge for the management of the protected wetland areas whose resources are already declining due to mismanagement and the declining water resources.

KEY APPROACHES BEING APPLIED

Approach #1: Legislation and direct assistance approach

Trying to control the trend of out-migration from rural area to urban area and the trend of turning to natural resources as a survival strategy, the main approach applied has been using legislation e.g the household registration system in the cities, the fisheries protection laws, forest protection statute, and so on. This approach has shown little impact in curbing the migration trend and protecting natural resources.

An additional approach has been the direct assistance approach where the poor are provided with land, credit, and housing in the hope of bringing them back to group (ii) (the self sufficient group). This is a short-term relief approach.

The third approach is to provide loans, together with technical support to the poor and education and vocational training to the young to prepare them for better employment and

income when migrating to big cities. This approach is, perhaps, the most effective approach in the long-term but is still applied only on a limited scale.

Approach #2: The reverse planning process

The approach to agriculture production planning applied by both the government and farmers has been in the order of: (i) Planning, (ii) Processing/quality control, (iii) Supply to the market. In this order of production planning, market demand is not assessed beforehand to serve as the basis of planning and production activities.

Approach #3: For agricultural expansion, canal and water to flush out acidity and toxicants.

With more than 1 million hectares of acid sulphate soil and acidic alluvial soil, to enable the expansion of agriculture the main approach is to rely on water and a dense network of canals for flushing out acidity and toxicants.
To enable intensification of agriculture, many dykes have been built for flood protection.

Approach #4: Dyking for intensification of agriculture

To enable double cropping or triple cropping of rice, in many areas, especially in flood prone areas of An Giang and Dong Thap province, polders have been built with tall dykes to prevent floods from coming into the fields. This approach helped increase rice production at the beginning when the soils were still fertile. However, it has been observed that rice yields inside the polders have started falling after some years as the dykes prevent the supply of nutrients attached to the sediments in the Mekong flood water. Tall dykes also prevent fish fingerlings and eggs from the Mekong water from coming into the fields.

Flood water also plays an important role in flushing out eggs and larvae of insects and pests in paddy fields. The absence of flood in flood controlled areas or during low flood years have resulted in the loss of such a natural service.

Approach #5: Conservation approach

The main approaches for conservation of remaining wetland ecosystems have been:

1. Protectionist approach

Protected areas have been established at wetland sites with high biodiversity values. The approach applied to these protected areas has been a protectionist approach where the local community is totally excluded from use of wetland resources. Currently, there are efforts in piloting community participation in use of wetland resources at a small scale.

2. Tree protection approach instead of conservation of ecosystem integrity

The wetland protected areas fall under the protected “forest” system and subject to the uniform policies, laws, and regulations applied to all forests. Trees are the main subject for protection efforts while other components, structures, and processes of wetland ecosystems are neglected. Staff of the wetland protected areas are trained mainly in forestry—or commercial forestry techniques rather than in conservation sciences. Consequently, grassland, for example, is oftentimes not regarded as an important component of the wetland ecosystem.

While the wetlands of the Mekong Delta, their ecosystems, and associated biodiversity were formed by and have long been adapted to an annually alternating wet and dry cycle, the hydrological rhythm is oftentimes not respected. To protect the trees from fire, tall dykes are built, canals are dug, and water is stocked all year round in the wetland protected areas, leading to the loss of the hydrological, soil, vegetation dynamics, and consequently the integrity of the ecosystem is severely injured.

3. Monoculture plantations

In inland freshwater wetlands, pure and dense stands of meleleuca are found while efforts to reintroduce other native tree species have been near non-existent.
Grasslands are not subject to protection efforts and not well regarded.

In the coastal zone, many "coastal protection forests" were planted in the 1980s with mainly Rhizophora while other pioneer species such as Avencia capable of accreting sediment and stabilizing the coastline, was not emphasized. In many areas with monoculture stands of Rhizophora, coastal erosion has become severe.

4. Sharp boundaries of protected areas:
The wetland protected areas in the Mekong Delta are often demarcated with sharp boundaries and there are no true buffer zones in any of the protected areas. The managements of the protected areas have no jurisdiction or influence over the activities in the surrounding areas outside the sharp boundaries.

At coastal protection forests, fishing activities take place heavily on the mudflats outside the sharp boundaries of the protected areas. While the monoculture stands of Rhizophora within the boundaries are being eroded by wind and wave actions, the pioneer species.

5. Inappropriate management of peat
Today, the main remaining peat areas in U Minh Region (including U Minh Thuong and U Minh Ha) are housed within the 2 national parks of U MInh Thuong and U MInh Ha and some smaller and thinner areas in the surrounding area of U Minh Ha National Park. While being protected, the peat layers are being degraded severely due to both fire and inappropriate hydrology regimes.

The main approach to peat management applied has been using canals and tall dykes to prevent fire. While this approach helped eliminate fire risk at the beginning (before 2002), the prolonged year round inundation is not appropriate to the seasonal hydrological needs of the wetland ecosystems, resulting in massive die off of the vegetation. To salvage the vegetation, water has been released. After that, however, the peat layer is subject to extreme dry conditions in the dry season due to that the canal systems causes a great and rapid loss of water in the dry season. The difference in elevation between the different parts of the peat domes also presents an additional challenge to hydrology management. The result is that the peat layer is being degraded gradually through: fire in the dry season, being flushed out to the canals, and oxidation. The peat layer in U Minh is a great store of carbon. The degradation of the peat layer is contributing greatly to carbon emissions.

THREATS, CHALLENGES, AND OPPORTUNITIES

The following section describe the threats and challenges that the Mekong Delta is currently facing or will have to address in the near, medium, and long-term.

Threat #1: Climate Change

The Mekong Delta has been identified by IPCC as among 5 areas in the world most vulnerable to Climate Change.
The Government of Vietnam, through the Ministry of Environment and Natural Resources, has developed projected scenarios based on the IPCC's scenario of medium emissions.

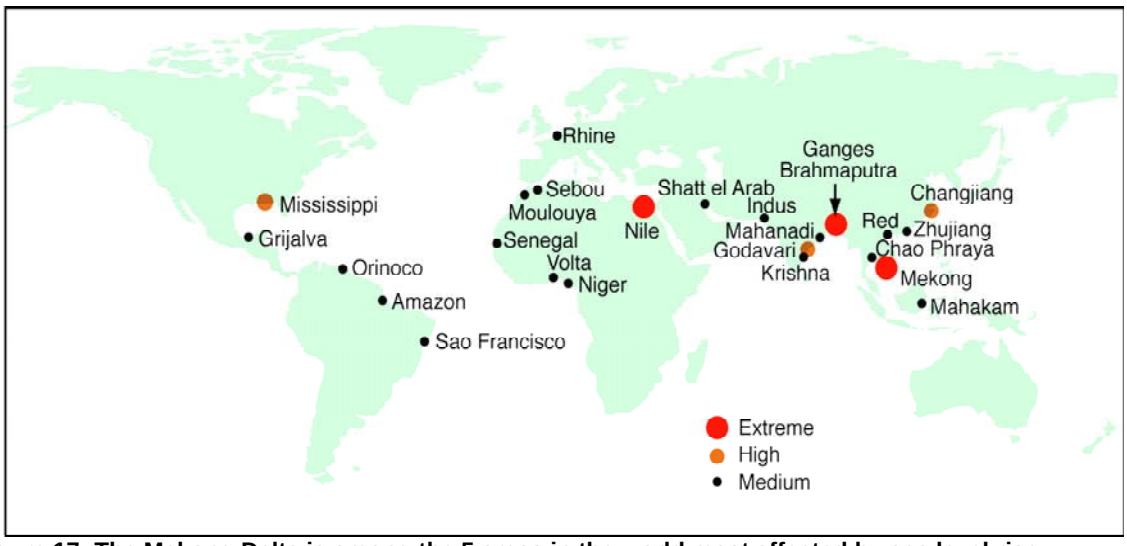


Figure 17: The Mekong Delta is among the 5 areas in the world most affected by sea level rise.

The following Table 3 is copied from the document of MONRE projecting the sea level rise in Vietnam to 2010 based on 3 emissions scenarios (low, medium, and high)

Table 3: Projected Sea level rise (cm) compared to 1980-1999

Scenario	Time milestones in the 21st century								
	2020	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	**2010**
Low (B1)	11	17	23	**28**	35	42	50	57	**65**
Medium B2)	12	17	23	**30**	37	46	54	64	**75**
High (A1FI)	12	17	24	**33**	44	57	71	86	**100**

Of the 3 emission scenarios, MONRE recommends that the Medium (B2) scenario is used for now, which projects that a sea level rise of 30cm is expected by 2050 and a rise of 75cm is expected by the end of the 21st century.

Based on the different scenarios of sea level rise, inundation maps have been developed for the delta (MONRE, 2009). Mean sea level of area was based on water levels measured at Vung Tau during 1979-2007. However, the inundation maps did not take into account effects of tide, storm surge, flood water, and other hydrologic factors.

ICEM (International Center for Environment Management) has projected that under the worst case scenario of 1m sea level rise by 2100, 10 provinces of the Mekong Delta will be affected as in the following Table 3:

Table 3: Provinces projected to be impacted by sea level rise by 2100 in the worst scenario

Impact of sea level rise

10 provinces most affected according to the scenario of sea level rise by 1 m:

Inundated area and percentage of inundated area by province:

- Bến Tre: 1 131km^2; 50,1%
- Long An: 2 169 km^2; 49,4%
- Trà Vinh: 1 021km^2; 45,7%
- Sóc Trăng: 1 425 km^2; 43,7%
- TP.HCM: 862km^2; 43,0%
- Vĩnh Long: 606km^2; 39,7%
- Bạc Liêu: 962km^2; 38,9%
- Tiền Giang: 783km^2; 32,7%
- Kiên Giang: 1 757km^2; 28,2%
- Cần Thơ: 758km^2; 24,7%

(Source: ICEM),

Under the same worst case scenario of 100cm SLR by 2100, total area of the Mekong Delta inundated is estimated at 15,116 km^2 as shown in Figure 18.

The map, however, seems to be based on elevation alone, without taking into account the dykes and other water control infrastructures in the Mekong Delta.

Figure 18: Map of Projected Inundation Area under the worst emission scenario by 2100

Recent manifestations of climate change have already been felt in the Delta.

Farmers have reported that they have felt the manifestations of climate change during the past 4 years and more acutely during the past 2 years. The felt manifestations include:

a. A shorter rainy season and a longer dry season.
b. Unpredictable and more intense rain events.
c. Higher sea levels

d. Higher temperature, especially in the dry season.

The observed consequences as reported by personal communication with farmers around the delta are that:

1. Productivity of fruit trees has been reduced.
2. Domestic animals (pig and poultry) are subject to more diseases.
3. More acidification of water in canals and river.
4. Saline intrusion further inland
5. Shortage of water for irrigation and domestic use in the dry season.
6. Poorer human health.

Threat #2: Upstream developments

2a. Mekong mainstream dams

Besides the existing and planned dams in China and the tributaries in the Mekong Basin which all have contributed to the changes of the water resource of the Mekong Delta, currently there are another 12 proposed dams on the main stem of the Mekong in the Lao, Lao-Thai, and Cambodia sections of the Mekong.

The MRC has commissioned an independent group of consultants to conduct an SEA study of these 12 planned dams. While the study is regional and lacks an emphasis on the Mekong Delta as the furthest downstream part, data from various reports from different stages of the SEA study show that the Mekong Delta, its economy, and its 18 million people will be seriously affected.

If all 12 proposed dams are built, the major impacts on the Mekong Delta are:

- ***75% of sediment reduction***. The sediment load coming to the Mekong Delta annually will be only 25% of what was before the dams. This will reduce the nutrient supply to the whole system (soil, agriculture, fisheries, and natural ecosystems). Agriculture production costs will increase as farmers will have to add more fertilizers to their rice field.

- **The annual production of 220,000-440,000 tons of wild caught fish at risk**
  The dams will create impassible barriers for migratory fishes, especially white fish who need to migrate upstream to breed. The flood pulse of the Mekong River triggers their spawning migration behavior. For the Mekong Delta in Vietnam alone, 220,000 to 440,000 tons of migratory fish will be at risk. At the current market price of approximately USD 2.5/kg of white fish, the likely loss in wild caught fisheries alone is 500 million to 1 billion USD/year. Wild caught fish is the main protein source for the poor and landless. The sudden drop of wild caught fish productivity will have a serious impact on the protein intake and health of the poor.

2b. Water diversion

- Both MD upstream-downstream developments will be associated with very dense populations and industrial blooming with intense water pollution. The combination of the hydrological regime, sea, soil-type and pollution poses original water quality management problems for all water use purposes. It is foreseen that, along the river

and canals in the MD, the water quality parameters are generally related to the use of fertilizers and pesticides in agriculture, of nutrient-rich effluents from aquaculture and animal husbandry and of wastewater from industrial plants and human populations. In the dry season and early rainy period, the polluted water seriously impacts the agricultural cultivation, aquaculture and domestic water supply.

- The expanding irrigation schemes for agricultural intensification in Cambodia associated with hydropower plant development policy in Laos and Cambodia will continue to increase the threats the losses of crop diversification and integrated farming. The MD will face more and more the problems of watering to the dry lands as well as more salinity intrusion in the low-flow months.
- There are also some water transfer projects, i.e., Chinese took nearly 50 billion cubic meters of water from Lancang (Mekong) to the Huang He river in the end of 1950s, and Thai moved water from Mekong river to northern and central regions of Thailand for irrigation. If these similar projects will being continued in the future, this will cause more serious impacts on environmental flow, economic and social development plans to the downstream countries.

2c. Upstream deforestation

- The demand of wood for construction and domestic furniture use in the region may lead the deforestation seriously. This will destruct vegetable covers of watersheds and make the normal flow changes.
- Whenever the upstream forest losses, the river bank erosion and landslides phenomena will be more frequency and level as a result. The change of river sedimentation, geomorphology and hydrology will threat the human settlements, stable agricultural cropping calendars and wetland conservation areas.

PROJECTED FUTURE TRENDS

Future trend #1: Agriculture has reached its physical limit—no more land for expansion

Almost all land area suitable for agriculture has been heavily used for agriculture. The total area of rice agriculture in 2009 has reached 3.9 million ha, almost the size of the Mekong Delta.

The increase in GDP will not be through further expansion of agriculture. It is only possible through improvement of quality of the farming system with better quality products fetching higher prices, or adding value by further processing.

Future Trend #2: Farming systems:

If current conditions remain constant, (e.g. no significant further impacts from upstream hydropower and further exacerbated climate change impacts), the farming systems are expected not to change in type but in quality. The major farming systems will be:

- For upper part of the delta: 2-3 rice crops or 2 rice crops and upland crop/year.
- For freshwater lower part of the Delta: 2-3 rice crops/year
- For coastal area, rice-shrimp/fish

Future Trend #3: Agriculture and fishery remain the two most important economic pillars of the delta

As analyzed above, given that the human resource quality of the Delta is low and that the Delta has little other significant economic potentials, such as mineral mining and valuable timber, agriculture and fishery will continue to remain its the 2 most important economic pillars.

Future Trend #4: Shortage of labor for agriculture as the migration trend continues

Given the current trends and the imminent challenges for the Mekong Delta, migration from the villages, to urban areas can be expected to continue, especially the young from landless families who usually supply agriculture labor to the landed farmers. Agriculture labor shortage, especially in peak seasons, such as the harvest season, can be expected to be acutely felt. Price of agriculture labor will increase and will help some of the young stay back in rural areas.

Future Trend #5: More Degraded Grey soils and more acidic soils

With the heavy use of the land, declining water resources and especially the reduction of the sediment load, it is expected that the current trend of the expansion of the degraded grey soil will continue in the future. As a result, agriculture productivity will be reduced. Meanwhile, upstream dams might cause lower dry season flows for short periods of time, depending on their operations (driven by peak time electricity demands); this will cause acidic soils to be exposed to the air and become activated. The activated acidity, once submerged again, will pollute the water environment and become toxic to aquatic life (and crops).

Future trend #6: Salinity intrusion will be further inland

The Lower Mekong Delta has a strong influence from the East Sea. Water from the Mekong River provide freshwater and prevent saline intrusion in the dry season. The shortage of fresh water resources of the Mekong River will result in saline intrusion further inland. Sea level rise will also involve in process of saline intrusion in the Lower Mekong Delta.

Future Trend #7: Coastal fishery productivity will be at risk:

The Mekong Waters pouring out into the coastal waters of the Mekong Delta forms a characteristic water zone known as the “Mekong Plume”. The sediment brought out by the Mekong Waters plays a critical role in nutrient supply to this zone. If the sediment load is reduced by 75% with all 12 dams built, it is reasonable to expect that the fishery productivity of the coastal zone will reduce, with a severe impact on the fishing industry, and the knock-on impacts on the processing industry, livelihoods, and the economy.

Future Trend #8: River bank and coastal erosion will be more severe. With the reduction of sediment by 75%, a phenomenon known as “hungry water” will take place. Hungry water or water deprived of sediment will try to find sediment to compensate as it passes and thus causes more erosion to the river bank and coastal areas.

Future Trend #9: Ecosystem integrity will continue to be deteriorated and biodiversity will reduce significantly

The current sectoral approach (fire control through water stocking and the tree protection approach) is expected to continue for some time in the foreseeable future and result in deterioration of wetland ecosystem integrity. Also, most of the food web of the wetland areas in the Mekong Delta depend on fish and aquatic life for nutrients. Nutrient supply in turn depends on the sediment load from the Mekong waters. If peak floods and sediment load continue to reduce due to the impacts of upstream dams and water diversion, it can be expected that population of water birds and other species that depend on fish will decline.

Future Trend #10: The poor will be worst hit

Among the rural groups, the poor and landless is the most vulnerable group. They have little capabilities (assets, financial capital, health and skills, and social relationships) to adapt to changes.

RECOMMENDATIONS

1. Climate change is real but not a tsunami: understanding is necessary before taking action!

While climate change is real and is taking place with its manifestations already felt locally, it is at the same time is a gradual process and not a tsunami. Adaptation is possible. The course to be taken needs to be thought out carefully to avoid waste and error. It is recommended that studies should be taken as the first step to better understand the likely impacts and possible adaptation measures at the lowest cost and maximum benefit.

A balance of all options needs to be considered for meeting various needs of various stakeholders in the short, medium, and long terms. Each option will have strengths and weaknesses as well as different types and scales of benefits and costs, including financial costs and environmental impacts.

The possible options include:

At national and provincial levels:

i) Protective infrastructures (dykes, embankment, dams, so on) to provide short-term protection and saline prevention to agriculture and assets. This option is expensive, requiring regular maintenance, and has negative environmental impacts such as preventing mangrove from migrating inland as sea level rises, disrupt coastal habitat connectivity, impede water flows and create stagnant water areas.

ii) Restoration of mangroves: this option provides multiple protection and environmental benefits, but takes time and also is difficult technically as sea level rises. Water might be too deep for planting and wave action too severe for mangrove to establish itself.

iii) Development of adaptive agriculture techniques, technologies, and varieties.

iv) Development of non-agriculture incomes. The development of industries, however, will have environmental implications that need to be assessed and planned carefully.

v) Proactive and gradual resettlement from marginal areas that will be submerged and cannot be protected in any case.

vi) Improvement of information, forecasting, and warning system.

vii) Educate the young to be able to enable them to compete in the cities in which they will inevitably end up… though this is more at the provincial level.

At Community level:
Collection actions can be taken to enhance and protect common resources such as fish ponds, developing village funds and shared processing facilities, improve irrigation, water retention and storage.

At farm level:
Changing seed varieties and crops, better irrigation systems, diversify crops, diversity income sources in order to enhance resilience and flexibility.
Mechanization and consolidation to cope with shortage of agricultural labor.

2. Support the Option to defer the decision to build mainstream dams for at least 10 years

Given that there are so many uncertainties and lack of information, that the impacts of the proposed 12 dams to the Mekong Delta can be serious, permanent, and irreversible, and that the benefits that Vietnam gain from the purchase of power from the dams is insignificant (meeting only 4.4% of total power demand of the country by 2025, and influencing less than 1.5% of electricity price within the country), the Government of Vietnam should support the option recommended by the SEA study to defer the decision for building the dams for at least 10 years until impacts are better understood and mitigation and adaptation measures are in place.

3. For conserving wetland biodiversity

The following approaches are recommended for improving conservation of wetlands to cope with the changing context:
i) Apply ecosystem approach to conservation. The approach to manage wetland protected areas should be shifted from the current "tree protection" approach to an ecosystem approach aiming at conserving ecosystems' integrity which entails the conservation of ecosystems' components, structures, and processes.
ii) The key to conserve the peatlands is an appropriate hydrology regime to ensures (a) the annual hydrological rhythm (the alternating wet and dry conditions), (b) the surface of the peat layer is still moist in the dry season (but no standing water), (c) no horizontal flows within the peat.
iv) The carbon market, especially the voluntary market, should be explored as a financial tool for conserving peat and forest.
iii) Local communities should be able to participate in sustainable use of wetland resources.
iv) In planting mangrove, multi-species should be planted so that mangrove is more capable of stabilizing and protecting the coastline; avoid planting single species mangroves such as only Rhizophora.
Expansion of protected areas.
a) community fishery reserves
b) functional bufferzones (areas the flood regularly and limit use of agri-chem)
c) rehab coastal wetlands

4. For land use

For coastal area:

- Reduce shrimp farming and replant mangrove
- Technology support for replanting mangroves in extreme saline soils, strong wind, waves, high erosion conditions.

At salt & freshwater interface:

- Promote shrimp+ rice farming model.
- Technical support for restoring original habitats (salt tolerant varieties, water supply system)
- Modify structures to restore sediment load to the field.

In drought prone areas:

- Rice + fish farming system
- Technical support to restore original habitats (drought tolerant varieties)
- Fish ponds acting as reservoirs to supply water to rice crop.

Acidic Areas:

- Rice + melaleuca
- Acid tolerant rice
- Irrigation and drainage water system
- Organic fertilizers
- Forest retain water and filters acidity and conserve biodiversity

Flooded areas

- Aquaculture in net cages
- Optimize sluice operation to allow sediment transport
- Diversify infrastructures
- Skyway to allow water to pass underneath
- Stilt or floating houses to adapt to flooding