CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY
PHILIPPINES

MANGROVE AND FISHPOND CHANGE DETECTION FOR THE VERDE ISLAND PASSAGE

This publication was prepared by Conservation International Philippines with funding from the United States Agency for International Development's Coral Triangle Support Partnership (CTSP)
(November 2011)

Cover photo: This mangrove forest is part of a Marine Protected Area in Balibago, Verde Islands Passage, Phillipines. Photo: © CTSP / Tory Read

Mangrove and Fishpond Change Detection for the Verde Island Passage

November 2011

USAID Project Number GCP LWA Award # LAG-A-00-99-00048-00

For more information on the six-nation Coral Triangle Initiative, please contact:

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
Interim Regional Secretariat
Ministry of Marine Affairs and Fisheries of the Republic of Indonesia
Mina Bahari Building II, 17th Floor
Jalan Medan Merdeka Timur No 16
Jakarta Pusat 10110 Indonesia
www.thecoraltriangleintitiave.org

This is a publication of the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). Funding for the preparation of this document was provided by the USAID-funded Coral Triangle Support Partnership (CTSP). CTSP is a consortium led by the World Wildlife Fund, The Nature Conservancy, and Conservation International with funding support from the United States Agency for International Development's Regional Asia Program.

Mangrove and Fishpond Change Detection for the Verde Island Passage

Introduction

On a separate report by this author entitled, *"Mangrove and Fishpond Mapping for the VIP"*, maps of mangrove cover and fishponds were derived from circa 1990 and 2010 satellite imageries Post-classification change detection was then applied using the separate circa 1990 and circa 2010 mangrove and fishpond maps. These maps having been derived from classified satellite imageries were converted into shapefiles to facilitate the change detection process. The satellite imagery, training and testing data, image classification methodology, accuracy assessment and classification results were all described in the said report and will no longer be repeated in this report.

Methodology

The change detection methodology is summarized in Figure 1.

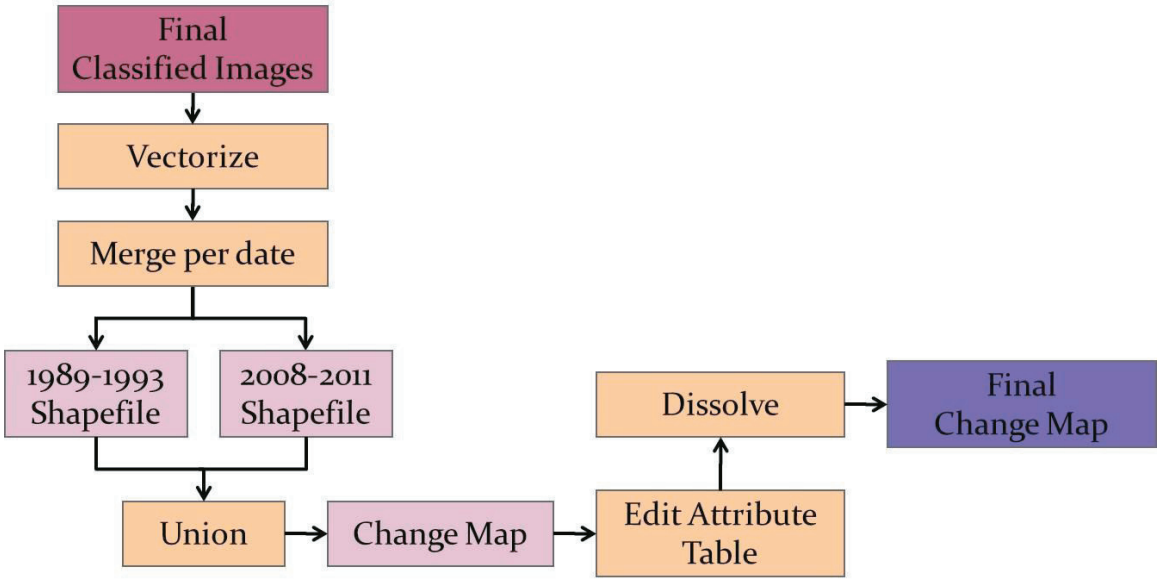

Figure 1. The change detection methodology

The change maps were derived by applying the Union tool of ArcGIS to the circa 1990 and circa 2010 shapefiles derived from the edited classified images, as described in the separate report. The attribute table of the resulting "unionized" shapefile was then edited by adding a field corresponding to the change type, e.g., mangrove to fishpond. The Dissolve tool was then applied to the edited shapefile to combine all polygon features of same change type into one polygon to derive the final change map. This map then carries the change types or change classes.

These change maps were then generalized into fewer change classes to make interpretation easier. All other original map classes apart from the mangrove, fishpond, and salt bed classes were combined into a single class called "others". The 'dry fishpond' and 'vegetated fishpond' classes were merged into 'dry/vegetated fishpond' and the 'bare salt bed' and 'vegetated salt bed' classes were combined as 'bare/vegetated salt bed'. The areas which are not common to both classifications and the change to/from cloud/shadow were excluded.

Change Detection Results

The post-classification change maps for the VIP, Batangas, Lubang Island Group (LIG), Occidental Mindoro, and Oriental Mindoro are shown in Figures 2 to 6. The cross-tabulation of the areas in hectares for each change type is given in Tables 1 to 5.

VIP Change

For the entire VIP (Table 1), there was a substantially large change or revision from all other classes to mangroves from 1990 to 2010 at 1,308 hectares. Meanwhile, the loss of mangrove cover was lower at 1,021 hectares. However, if we only look at the change between fishponds and mangroves, there seems to be an alarming conversion from mangroves to fishponds rather than the reverse. Based on the change matrix, 357 hectares of mangroves were converted to fishpond classes. Of which, 249 hectares were mangroves to fishponds and 107 hectares were mangroves to dry/vegetated fishponds. Fishpond-to-mangrove change was only less than half of the mangrove-to-fishpond change, which was at 176 hectares (includes fishpond and dry/vegetated fishpond classes). A total of 1,483 hectares were excluded from the VIP change computations and mapping. These excluded pixels were those that were inconsequential to the analysis, such as areas of change to/from cloud or shadow and pixels that were only from one image circa (either 1990 or 2010 only).

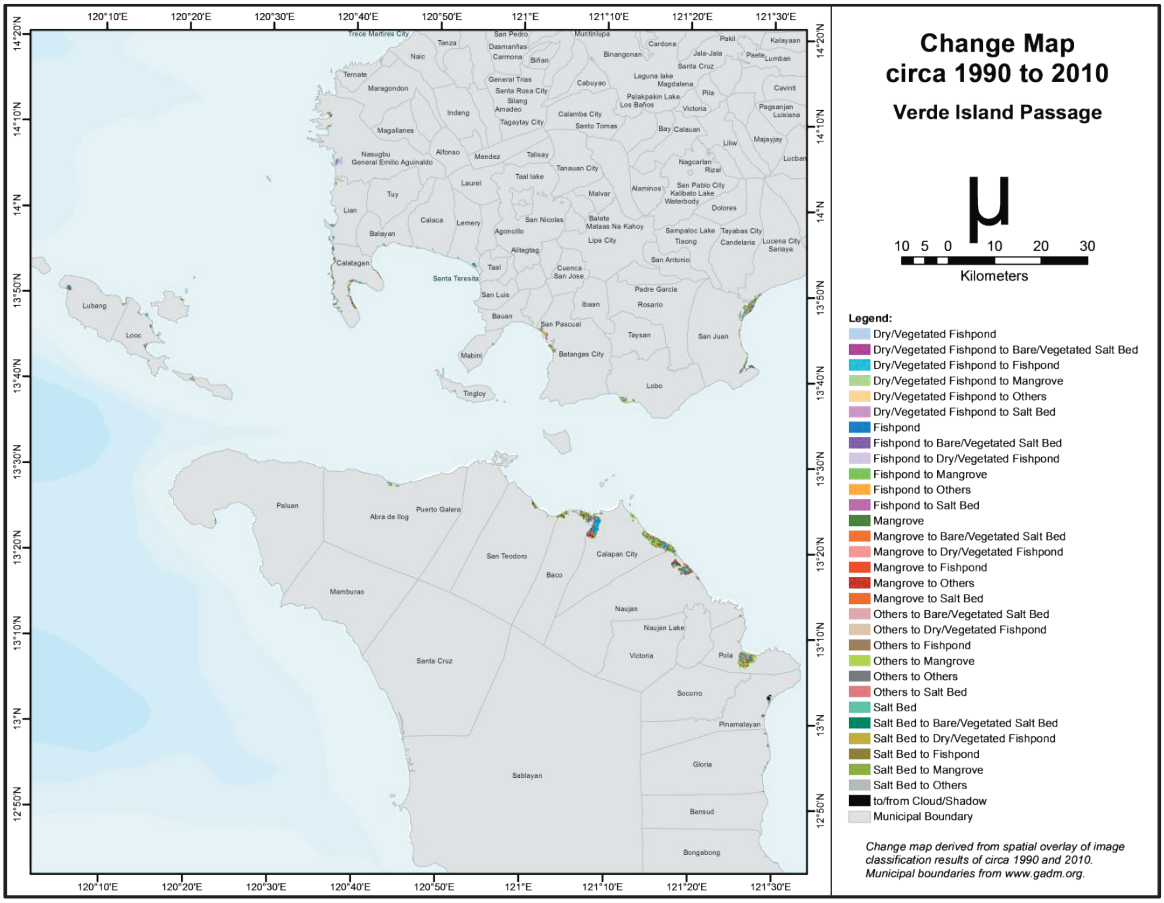

Figure 2. Change map of the Verde Island Passage.

Table 1. Change matrix for the Verde Island Passage

circa 1990	circa 2010						total
	mangrove	dry/veg. fp[1]	fishpond	salt bed	bare/veg. salt[2]	others	
mangrove	**1,242.95**	107.08	249.46	0.53	1.00	662.74	**2,263.76**
dry/veg. fp[1]	74.41	**126.56**	315.80	0.92	0.70	199.55	**717.94**
fishpond	101.32	111.14	**748.86**	2.92	0.89	248.52	**1,213.65**
salt bed	0.02	0.19	1.65	**0.83**	0.20	0.31	**3.20**
bare/veg. salt[2]	0.00	0.00	0.00	0.00	**0.00**	0.00	**0.00**
others	1,132.33	184.11	373.12	5.31	4.70	**2,320.74**	**4,020.31**
total	**2,551.03**	**529.08**	**1,688.89**	**10.51**	**7.49**	**3,431.86**	**4,439.94**

[1] Dry/vegetated fishpond
[2] Bare/vegetated salt bed

Batangas Change

The mangrove-fishpond change for Batangas was similar to that of the VIP, with more areas of mangrove-to-fishpond change than fishpond-to-mangrove change. The ratio of mangrove-to-fishpond change, however, was lower at 1.2 compared to VIP's change ratio of 2.0. A total of 1,050 hectares were excluded from the Batangas change computations and mapping.

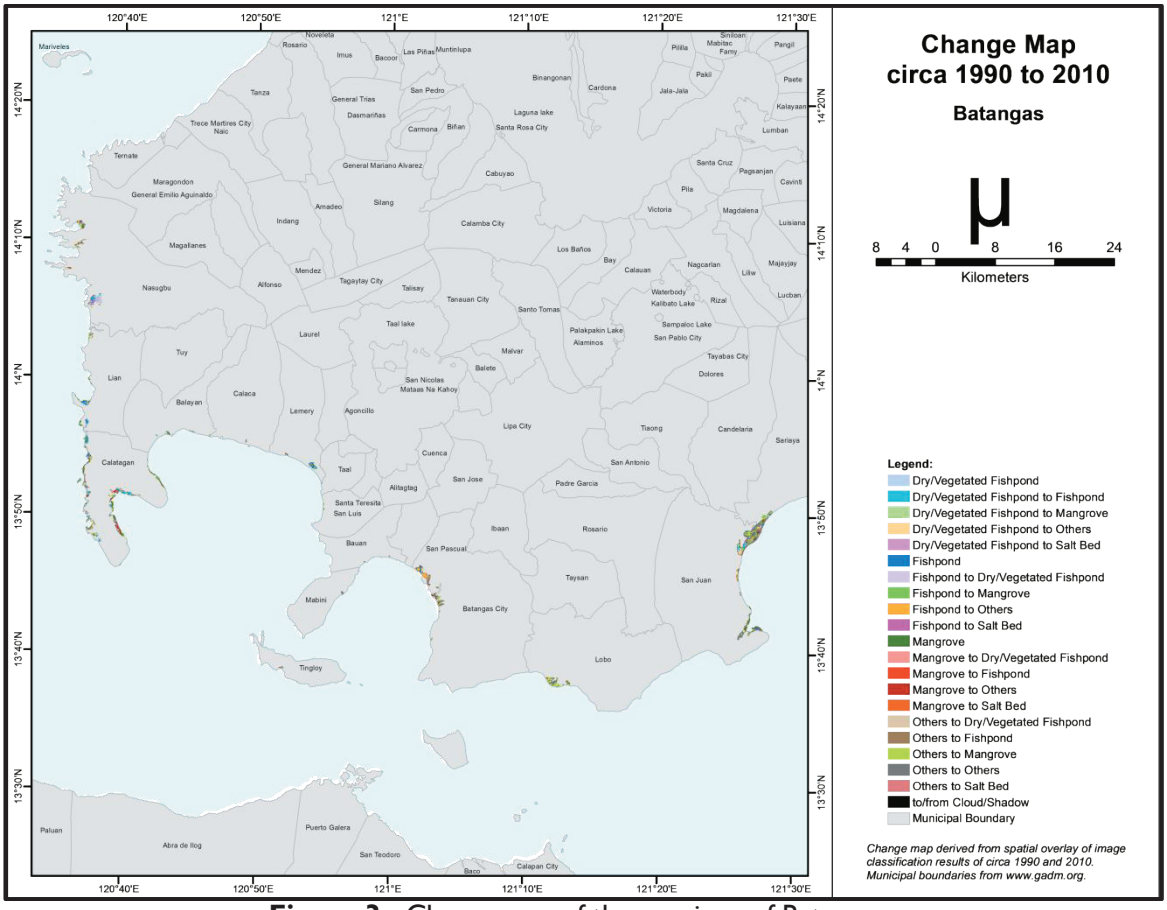

Figure 3. Change map of the province of Batangas.

Table 2. Change matrix for the Batangas province

circa 1990	circa 2010						total
	mangrove	dry/veg. fp[3]	fishpond	salt bed	bare/veg. salt[4]	others	
mangrove	**267.43**	33.57	53.83	0.42	0.00	172.79	**528.04**
dry/veg. fp[3]	32.24	**75.42**	104.49	0.90	0.00	117.47	**330.52**
fishpond	38.96	59.44	**229.22**	1.90	0.00	140.34	**469.86**
salt bed	0.00	0.00	0.00	**0.00**	0.00	0.00	**0.00**
bare/veg. salt[4]	0.00	0.00	0.00	0.00	**0.00**	0.00	**0.00**
others	317.64	104.13	136.65	0.60	0.00	**1,068.05**	**1,627.07**
total	**656.27**	**272.56**	**524.19**	**3.82**	**0.00**	**1,498.65**	**1,640.12**

LIG Change

Lubang Island Group (LIG) exhibited the most alarming mangrove-to-fishpond conversion among all the study areas. Mangrove-to-fishpond change was more than ten times higher than the fishpond-to-mangrove change. Mangrove-to-dry/vegetated fishpond change was more than three times higher than the reverse change. A total of 98 hectares were excluded from the LIG change computations and mapping.

[3] Dry/vegetated fishpond
[4] Bare/vegetated salt bed

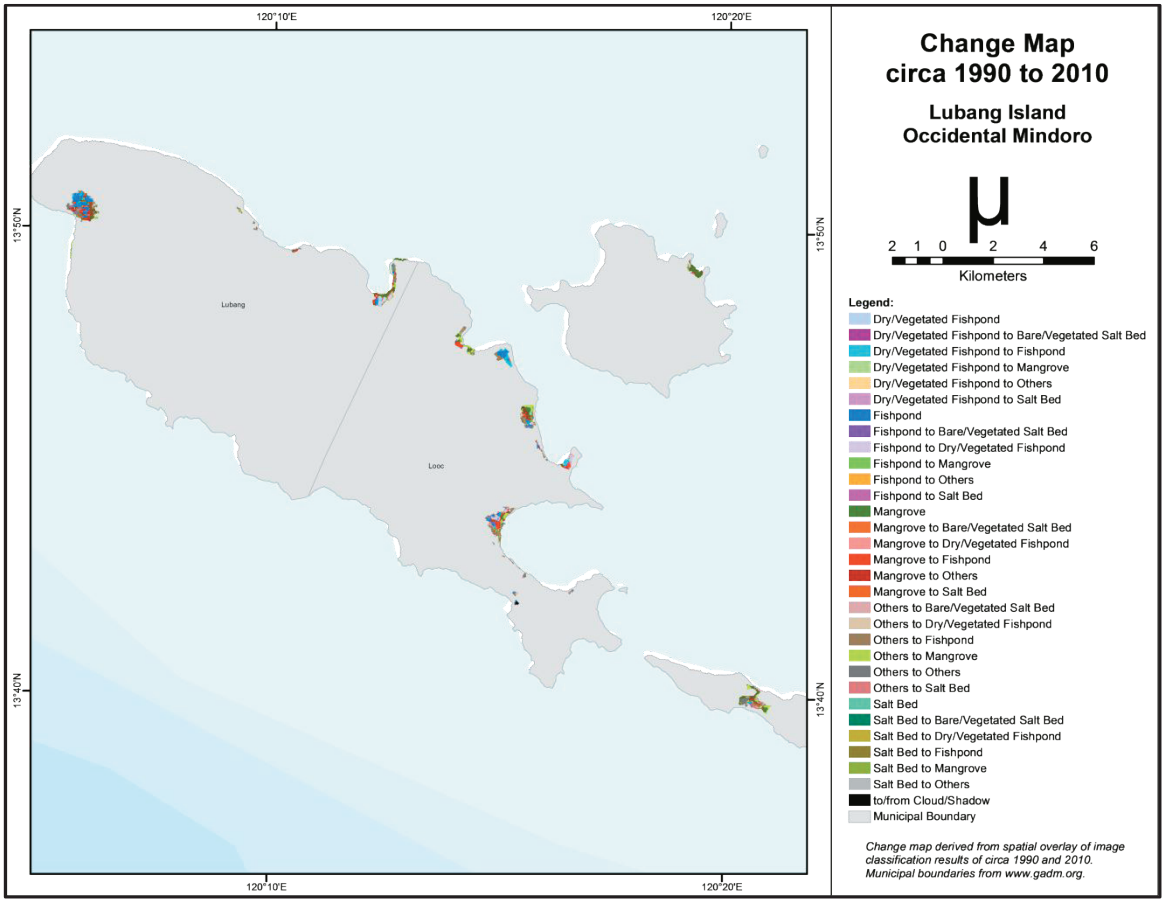

Figure 4. Change map of Lubang Island Group, province of Occidental Mindoro.

Table 3. Change matrix for Lubang Island Group

circa 1990	circa 2010						total
	mangrove	dry/veg. fp[5]	fishpond	salt bed	bare/veg. salt[6]	others	
mangrove	**65.90**	6.82	35.79	0.11	1.00	22.41	**132.03**
dry/veg. fp[5]	2.22	**9.83**	16.92	0.02	0.70	2.55	**32.24**
fishpond	3.54	10.29	**56.18**	1.02	0.89	4.91	**76.83**
salt bed	0.02	0.19	1.65	**0.83**	0.02	0.31	**3.02**
bare/veg. salt[6]	0.00	0.00	0.00	0.00	**0.00**	0.00	**0.00**
others	34.30	11.75	67.02	4.67	4.70	**47.14**	**169.58**
total	**105.98**	**38.88**	**177.56**	**6.65**	**7.31**	**77.32**	**179.88**

[5] Dry/vegetated fishpond
[6] Bare/vegetated salt bed

Occidental Mindoro Change

The remaining portion of Occidental Mindoro had the least amount of mangroves and fishponds compared to the other study areas. However, the change still leaned towards mangrove-to-fishpond change at 0.7 hectares versus the 0.1 hectares of fishpond-to-mangrove change. The change from all classes to mangrove was also quite positive at 27 hectares compared to the mangrove loss at 7 hectares. A total of 19 hectares were excluded from the Occidental Mindoro change computations and mapping.

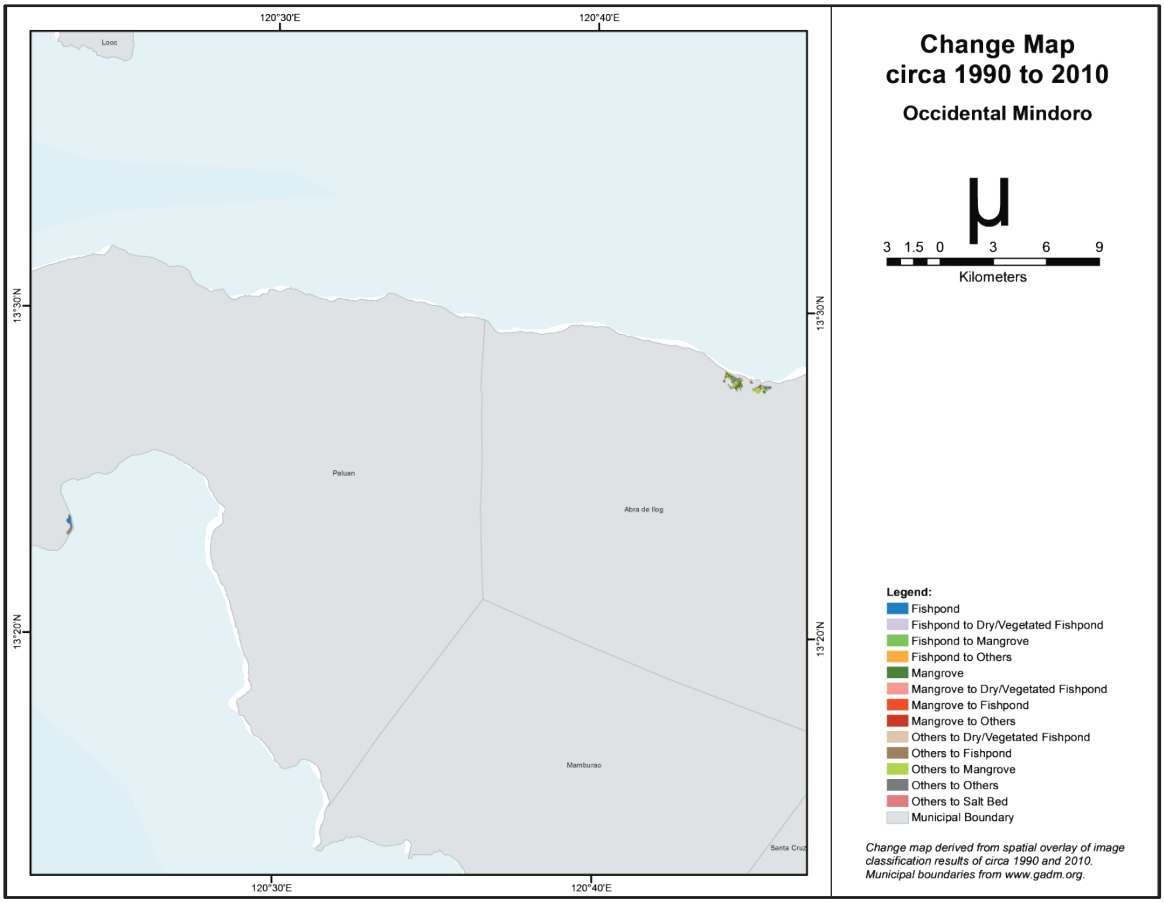

Figure 5. Change map of the province of Occidental Mindoro.

Table 4. Change matrix for Occidental Mindoro

circa 1990	circa 2010						total
	mangrove	dry/veg. fp[7]	fishpond	salt bed	bare/veg. salt[8]	others	
mangrove	**13.46**	0.04	0.71	0.00	0.00	6.02	**20.23**
dry/veg. fp[7]	0.00	**0.00**	0.00	0.00	0.00	0.00	**0.00**
fishpond	0.09	0.08	**9.30**	0.00	0.00	1.13	**10.60**
salt bed	0.00	0.00	0.00	**0.00**	0.00	0.00	**0.00**
bare/veg. salt[8]	0.00	0.00	0.00	0.00	**0.00**	0.00	**0.00**
others	26.42	0.72	6.68	0.04	0.00	**47.22**	**81.08**
total	**39.97**	**0.84**	**16.69**	**0.04**	**0.00**	**54.36**	**69.98**

Oriental Mindoro Change

The same unfortunate trend as the other study areas was observed for Oriental Mindoro, with a total of 159 hectares mangrove-to-fishpond change compared to 59 hectares fishpond-to-mangrove change. A total of 316 hectares were excluded from the Oriental Mindoro change computations and mapping.

[7] Dry/vegetated fishpond
[8] Bare/vegetated salt bed

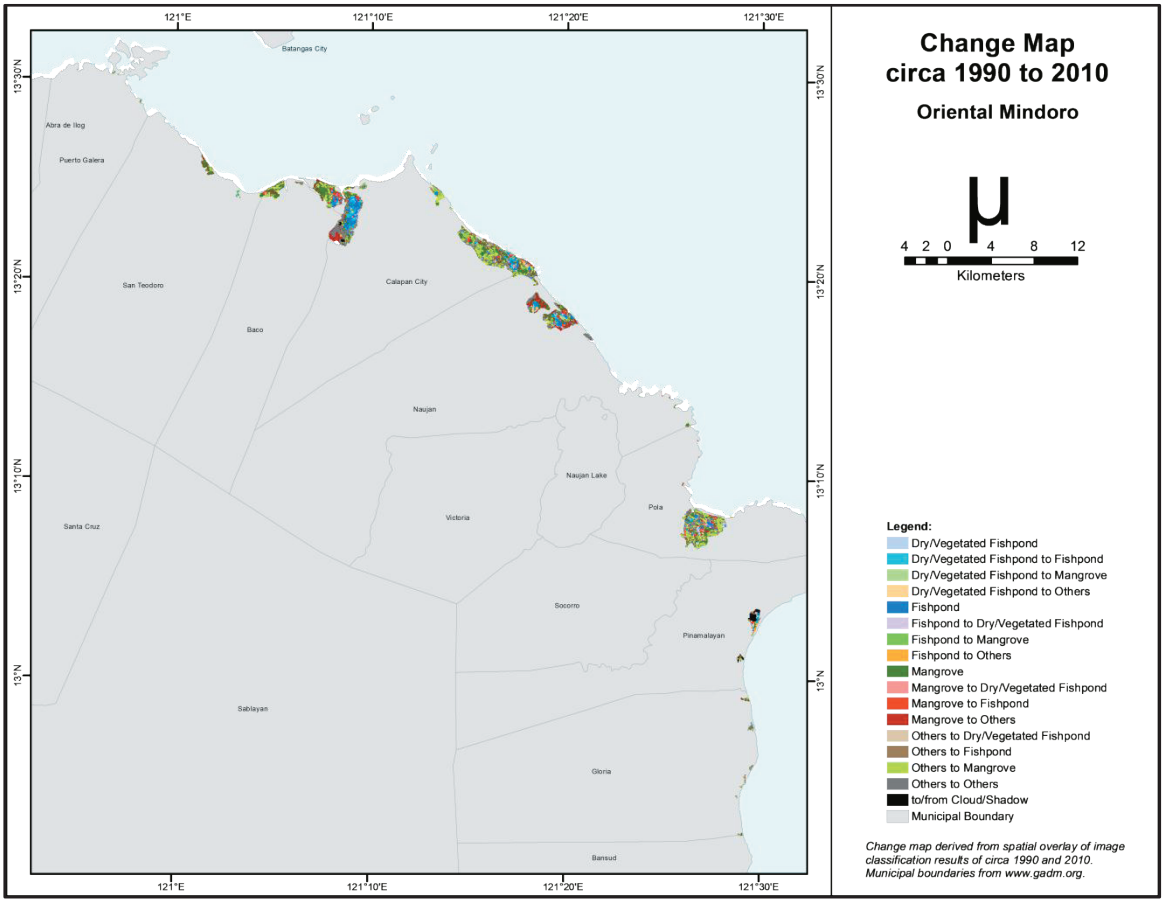

Figure 6. Change map of the province of Oriental Mindoro.

Table 5. Change matrix for Oriental Mindoro

circa 1990	circa 2010						total
	mangrove	dry/veg. fp[9]	fishpond	salt bed	bare/veg. salt[10]	others	
mangrove	**896.16**	66.65	159.13	0.00	0.00	461.52	**1,583.46**
dry/veg. fp[9]	39.95	**41.32**	194.39	0.00	0.00	79.52	**355.18**
fishpond	58.72	41.33	**454.16**	0.00	0.00	102.14	**656.35**
salt bed	0.00	0.00	0.00	**0.00**	0.00	0.00	**0.00**
bare/veg. salt[10]	0.00	0.00	0.00	0.00	**0.00**	0.00	**0.00**
others	753.96	67.51	162.77	0.00	0.00	**1,158.33**	**2,142.57**
total	**1,748.79**	**216.81**	**970.45**	**0.00**	**0.00**	**1,801.51**	**2,549.97**

[9] Dry/vegetated fishpond
[10] Bare/vegetated salt bed

Conclusions

It was evident in the change analysis of the two-date classifications that substantially large mangrove areas have been converted to fishpond areas by 2010. All five geographic extents (VIP, Batangas, Lubang Island Group, Occidental Mindoro and Oriental Mindoro) were consistent in this respect. Some municipalities/cities which exhibited such widespread mangrove-to-fishpond conversion include Nasugbu, Pagapas Bay, Looc, Calapan City, and Pola.

If the areas classified as 'dry fishpond' and 'vegetated fishpond' are, indeed, idle or abandoned, these are several potential areas for mangrove rehabilitation in the entire study area. These will include the mapped areas in the municipalities of Nasugbu, Calatagan, Lubang, and Looc.

CORAL TRIANGLE
INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY
PHILIPPINES