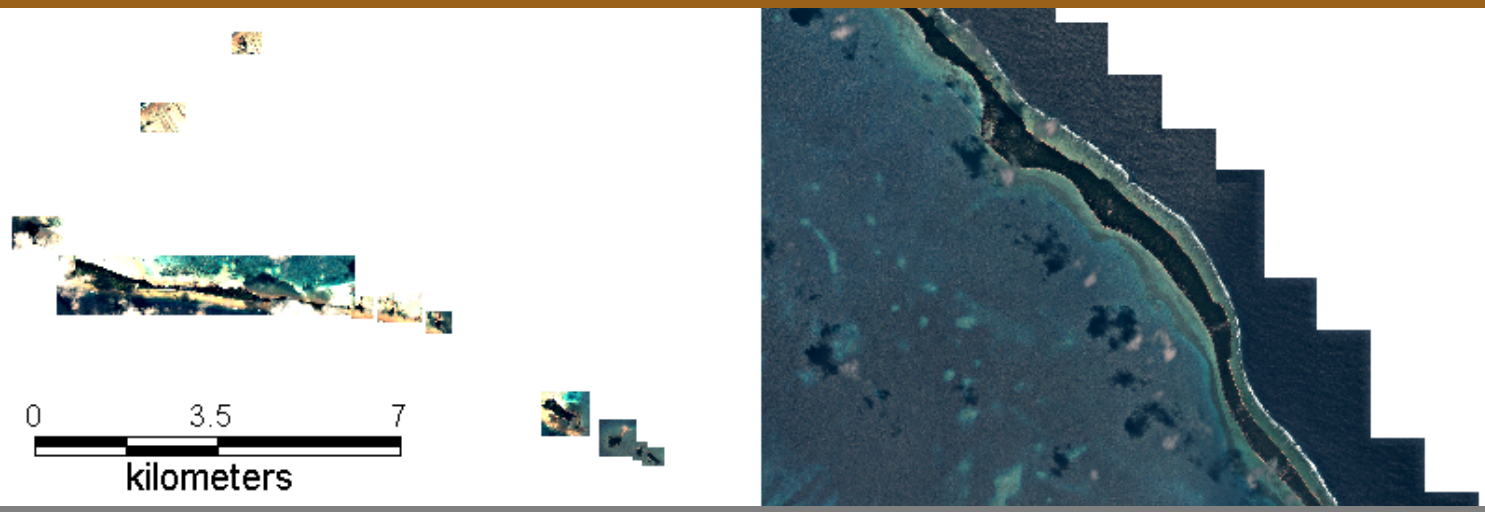
SPC
Secretariat of the Pacific Community

Applied Geoscience and Technology Division (SOPAC)

Technical Note – Land cover type mapping utilising pan-sharpened QuickBird and multi-spectral IKONOS images, Abaiang, Kiribati

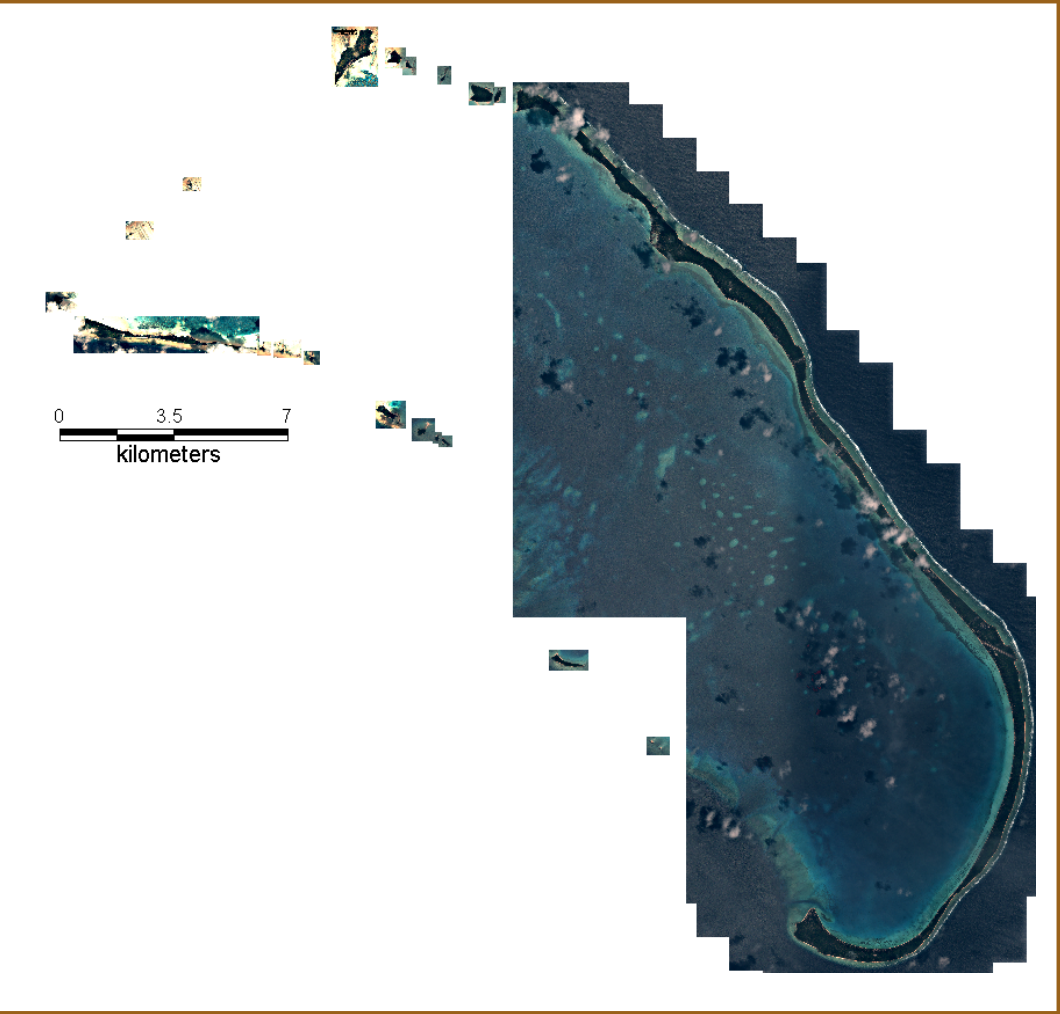


January 2011

SOPAC TECHNICAL NOTE (PR47)

Wolf Forstreuter[1], Taato Murdoch[2]

[1]GIS & Remote Sensing Section, Technical Support Services, [2]Republic of Kiribati



This report may also be referred to as SPC SOPAC Division Published Report 47

Applied Geoscience and Technology Division (SOPAC)
Private Mail Bag
GPO Suva
Fiji Islands
Telephone: (679) 338 1377
Fax: (679) 337 0040
E-mail: director@sopac.org
Web site: http://www.sopac.org

Table of Contents

1 Introduction

Vegetation mapping for low lying islands started as a initiative related to the FAO programme **M**onitoring **A**ssessing and **R**eporting (MAR) in Tuvalu where SPC programme Forest and Trees worked together with SOPAC to plan future activities in this area. In 2009 a monitoring system was established in the Agriculture Department in Kiribati and initial training was provided through SPC/SOPAC. The Agriculture Department worked together with the Department of Environment and the Lands Department on the vegetation mapping task. Kiribati - like Tuvalu at a later stage - expressed more reasons to map the vegetation of their outer islands. They explained the importance of mapping the coconut resource because accurate figures are required to attract bio fuel related projects. Spatial and statistical information of the coconut resource is also required to be able to start regeneration activities as most coconut palm stands are getting senile. Another important reason to map the vegetation is the food security of low lying islands where the Agriculture Department needs to know the available amount and condition of pandanas, coconut and bread fruit to support management of this natural resource. Finally the vegetation cover is supposed to be documented to be able to record any changes through a re-mapping at a later stage. It is presumed that the impact of climate change will be visible through vegetation changes which refer especially to mangrove vegetation.

SPC Forest and Trees is financing one position at SOPAC's GIS&RS section where Taato Murdoch from Kiribati fills this position and did most of the mapping and supports the mapping in Kiribati's Environment, Agriculture and Lands Department.

All mapping is based on visual interpretation at 1:5,000 working scale. The mapping is based on geo-coded very high resolution image data (multi-spectral IKONOS). However, the geo-location accuracy is not at 1:5,000 scale level; there can be a linear shift, which can be corrected as soon as reference image points are established. If a geo-location correction will be applied, the area calculation will not be effected. To stratify the coconut cover into three density classes pan-sharpened QuickBird images displayed with Google Earth were used parallel to the multi-spectral IKONOS images.

2 Image Data Used

Satellite Image Type: IKONOS

Creation Date: 2003

Projection Information :

Projection Zone : 59

Spheroid Name : WGS 84

Georeferenced to : UTM, Zone 59

Hemisphere : North

3 Abaiang Atoll Area Statistic, Summary 2003

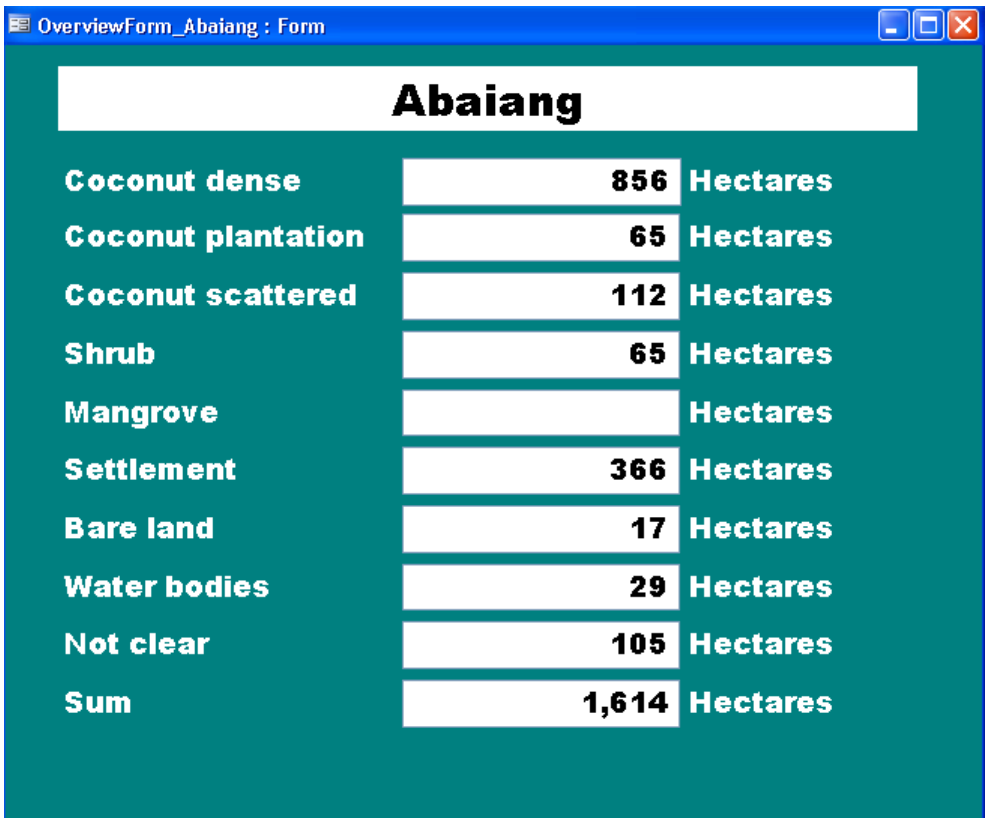


Table 3-1: *Summary Access database display for different vegetation strata of Abaiang. More about the different starta see chapter "Interpretation Key"*

4 Area Statistic, by Islands (Villages)

4.1 TERA (Takarano-Tabontebike) 2003

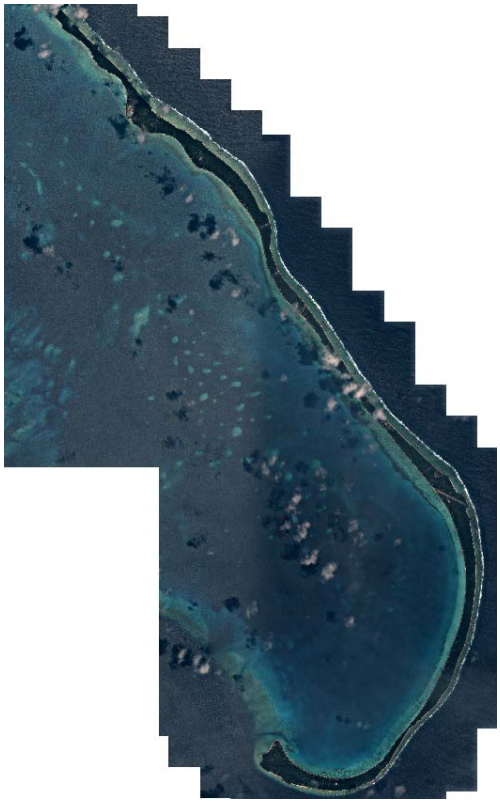


Figure 4.1-1: *Island section Takarano-Tabontebike*

CalculationForm_ABAI_TERA : Form

Takarano-Tabontebike

Coconut dense	7,112,702	square metres
Coconut plantation	583,554	square metres
Coconut scattered	966,049	square metres
Shrub	492,228	square metres
Mangrove		square metres
Settlement	3,366,665	square metres
Bare land	159,663	square metres
Water bodies	249,070	square metres
Not clear	981,649	square metres
Sum	13,911,581	square metres

Table 4.1-1: *Area in m^2 for mapped vegetation strata of island section Takarano-Tabontebike*

VegetationClassName	ID	Area
Coconut plantation	ABAI_TERA_0001	35,492
Water bodies	ABAI_TERA_0002	91,012
Settlement	ABAI_TERA_0003	177,634
Shrub vegetation	ABAI_TERA_0004	20,009
Shrub vegetation	ABAI_TERA_0005	170,557
Coconut plantation	ABAI_TERA_0006	28,503
Coconut plantation	ABAI_TERA_0007	31,210
Coconut scattered	ABAI_TERA_0008	59,732
Coconut dense	ABAI_TERA_0009	130,287
Shrub vegetation	ABAI_TERA_0010	17,139
Unclear	ABAI_TERA_0011	76,588
Coconut dense	ABAI_TERA_0012	106,924
Settlement	ABAI_TERA_0013	366,762
Coconut scattered	ABAI_TERA_0014	232,149
Bare land	ABAI_TERA_0015	4,627
Shrub vegetation	ABAI_TERA_0016	28,288
Bare land	ABAI_TERA_0017	5,846
Coconut dense	ABAI_TERA_0018	13,065
Shrub vegetation	ABAI_TERA_0019	31,621
Water bodies	ABAI_TERA_0020	22,699
Coconut plantation	ABAI_TERA_0021	27,721
Coconut dense	ABAI_TERA_0022	172,997
Shrub vegetation	ABAI_TERA_0023	7,678
Shrub vegetation	ABAI_TERA_0024	27,959
Settlement	ABAI_TERA_0025	27,733
Shrub vegetation	ABAI_TERA_0026	15,640
Coconut dense	ABAI_TERA_0027	229,786
Shrub vegetation	ABAI_TERA_0028	10,954
Water bodies	ABAI_TERA_0029	20,786
Coconut plantation	ABAI_TERA_0030	26,196
Settlement	ABAI_TERA_0031	5,020
Shrub vegetation	ABAI_TERA_0032	11,520
Settlement	ABAI_TERA_0033	22,659
Water bodies	ABAI_TERA_0034	2,185
Coconut plantation	ABAI_TERA_0035	41,107
Coconut dense	ABAI_TERA_0036	719,661
Settlement	ABAI_TERA_0037	154,372
Water bodies	ABAI_TERA_0038	2,619
Bare land	ABAI_TERA_0039	988
Shrub vegetation	ABAI_TERA_0040	10,788
Settlement	ABAI_TERA_0041	6,483
Shrub vegetation	ABAI_TERA_0042	6,796
Bare land	ABAI_TERA_0043	2,948
Settlement	ABAI_TERA_0044	384,709

Shrub vegetation	ABAI_TERA_0045	1,490
Shrub vegetation	ABAI_TERA_0046	6,701
Shrub vegetation	ABAI_TERA_0047	6,641
Shrub vegetation	ABAI_TERA_0048	17,541
Shrub vegetation	ABAI_TERA_0049	7,279
Coconut plantation	ABAI_TERA_0050	22,182
Coconut scattered	ABAI_TERA_0051	13,832
Coconut dense	ABAI_TERA_0052	1,500,477
Bare land	ABAI_TERA_0053	9,934
Bare land	ABAI_TERA_0054	96,526
Coconut scattered	ABAI_TERA_0055	19,970
Shrub vegetation	ABAI_TERA_0056	13,511
Coconut dense	ABAI_TERA_0057	33,617
Coconut scattered	ABAI_TERA_0058	32,496
Coconut dense	ABAI_TERA_0059	23,540
Coconut plantation	ABAI_TERA_0060	34,783
Shrub vegetation	ABAI_TERA_0061	12,565
Bare land	ABAI_TERA_0062	1,396
Coconut dense	ABAI_TERA_0063	137,786
Bare land	ABAI_TERA_0064	3,586
Unclear	ABAI_TERA_0065	107,087
Coconut dense	ABAI_TERA_0066	355,790
Settlement	ABAI_TERA_0067	682,623
Unclear	ABAI_TERA_0068	259,494
Unclear	ABAI_TERA_0069	194,970
Coconut dense	ABAI_TERA_0070	146,125
Coconut plantation	ABAI_TERA_0071	20,464
Coconut dense	ABAI_TERA_0072	28,618
Coconut scattered	ABAI_TERA_0073	21,909
Coconut dense	ABAI_TERA_0074	12,906
Settlement	ABAI_TERA_0075	140,018
Coconut dense	ABAI_TERA_0076	307,623
Coconut plantation	ABAI_TERA_0077	11,488
Coconut scattered	ABAI_TERA_0078	7,875
Coconut dense	ABAI_TERA_0079	95,103
Coconut plantation	ABAI_TERA_0080	6,173
Coconut plantation	ABAI_TERA_0081	7,887
Settlement	ABAI_TERA_0082	228,522
Bare land	ABAI_TERA_0083	1,654
Coconut scattered	ABAI_TERA_0084	69,517
Coconut dense	ABAI_TERA_0085	95,204
Coconut plantation	ABAI_TERA_0086	43,751
Shrub vegetation	ABAI_TERA_0087	8,051
Coconut scattered	ABAI_TERA_0088	39,742
Settlement	ABAI_TERA_0089	137,439

Coconut dense	ABAI_TERA_0090	237,138
Coconut scattered	ABAI_TERA_0091	9,441
Coconut dense	ABAI_TERA_0092	334,260
Coconut plantation	ABAI_TERA_0093	21,834
Shrub vegetation	ABAI_TERA_0094	5,688
Bare land	ABAI_TERA_0095	7,702
Coconut dense	ABAI_TERA_0096	121,001
Coconut plantation	ABAI_TERA_0097	161,386
Coconut scattered	ABAI_TERA_0098	326,715
Shrub vegetation	ABAI_TERA_0099	8,233
Shrub vegetation	ABAI_TERA_0100	10,502
Bare land	ABAI_TERA_0101	5,494
Bare land	ABAI_TERA_0102	4,326
Settlement	ABAI_TERA_0103	480,739
Coconut plantation	ABAI_TERA_0104	19,728
Settlement	ABAI_TERA_0105	31,009
Shrub vegetation	ABAI_TERA_0106	4,668
Bare land	ABAI_TERA_0107	1,454
Bare land	ABAI_TERA_0108	1,230
Coconut scattered	ABAI_TERA_0109	21,126
Settlement	ABAI_TERA_0110	126,379
Settlement	ABAI_TERA_0111	14,664
Unclear	ABAI_TERA_0112	51,393
Unclear	ABAI_TERA_0113	238,280
Settlement	ABAI_TERA_0114	147,568
Coconut scattered	ABAI_TERA_0115	65,906
Shrub vegetation	ABAI_TERA_0116	2,711
Coconut plantation	ABAI_TERA_0117	6,083
Settlement	ABAI_TERA_0118	32,631
Coconut dense	ABAI_TERA_0119	23,479
Shrub vegetation	ABAI_TERA_0120	2,484
Coconut dense	ABAI_TERA_0121	185,381
Unclear	ABAI_TERA_0122	53,837
Settlement	ABAI_TERA_0123	81,350
Coconut dense	ABAI_TERA_0124	253,370
Shrub vegetation	ABAI_TERA_0125	12,740
Shrub vegetation	ABAI_TERA_0126	6,418
Settlement	ABAI_TERA_0127	110,153
Settlement	ABAI_TERA_0128	8,202
Shrub vegetation	ABAI_TERA_0129	3,883
Bare land	ABAI_TERA_0130	11,952
Coconut plantation	ABAI_TERA_0131	37,565
Coconut dense	ABAI_TERA_0132	768,475
Coconut scattered	ABAI_TERA_0133	45,639
Water bodies	ABAI_TERA_0134	9,235

Water bodies	ABAI_TERA_0135	100,534
Shrub vegetation	ABAI_TERA_0136	2,173
Coconut dense	ABAI_TERA_0137	1,080,090
Sum		13,911,581

Table 4.1-2: *Polygons calculated for island section Takarano-Tabontebike*

4.2 ANAR (Anariki) 2003

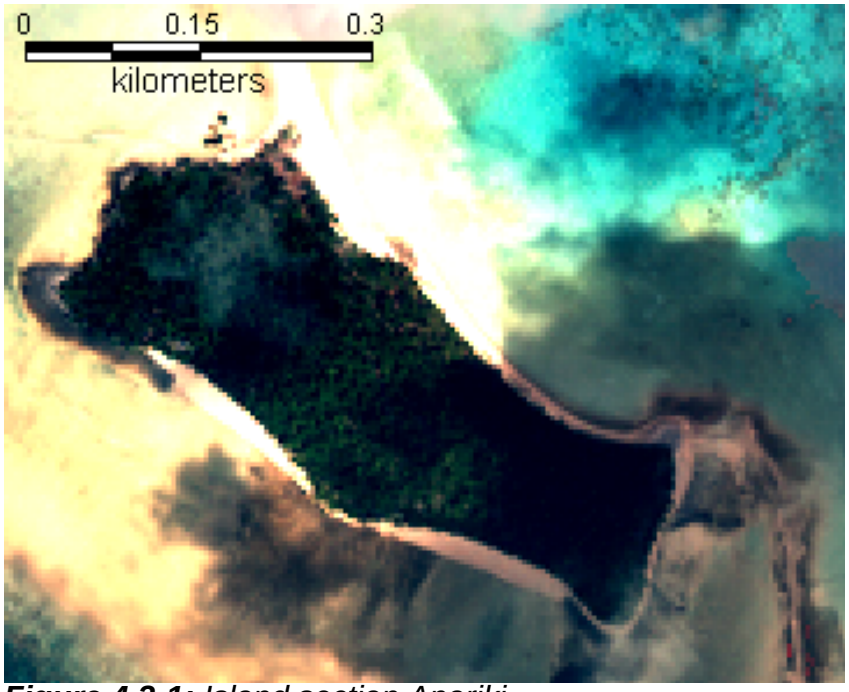


Figure 4.2-1: *Island section Anariki*

CalculationForm_ABAI_ANAR : Form

Anariki		
Coconut dense	84,253	square metres
Coconut plantation		square metres
Coconut scattered		square metres
Shrub	9,620	square metres
Mangrove		square metres
Settlement		square metres
Bare land		square metres
Water bodies		square metres
Not clear		square metres
Sum	93,873	square metres

Table 4.2-1: *Area in m^2 for mapped vegetation strata of island section Anariki*

VegetationClassName	ID	Area
Shrub vegetation	ABAI_ANAR_0001	5,074
Coconut dense	ABAI_ANAR_0002	84,253
Shrub vegetation	ABAI_ANAR_0003	2,190
Shrub vegetation	ABAI_ANAR_0004	2,357
Sum		93,873

Table 4.2-2: *Polygons calculated for island section Anariki*

4.3 NUOT (Nuotaea) 2003

Figure 4.3-1: *Island section Nuotaea*

CalculationForm_ABAI_NUOT : Form

Nuotaea		
Coconut dense	526,103	square metres
Coconut plantation		square metres
Coconut scattered	79,342	square metres
Shrub	23,243	square metres
Mangrove		square metres
Settlement	158,257	square metres
Bare land	4,099	square metres
Water bodies		square metres
Not clear	65,458	square metres
Sum	856,502	square metres

Table 4.3-1: *Area in m^2 for mapped vegetation strata of island section Nuotaea*

VegetationClassName	ID	Area
Coconut scattered	ABAI_NUOT_0001	23,216
Coconut dense	ABAI_NUOT_0002	31,065
Unclear	ABAI_NUOT_0003	65,458
Coconut dense	ABAI_NUOT_0004	123,760
Settlement	ABAI_NUOT_0005	158,257
Bare land	ABAI_NUOT_0006	4,099
Shrub vegetation	ABAI_NUOT_0007	16,892
Coconut dense	ABAI_NUOT_0008	24,839
Coconut scattered	ABAI_NUOT_0009	56,126
Shrub vegetation	ABAI_NUOT_0010	2,466
Shrub vegetation	ABAI_NUOT_0011	3,885
Coconut dense	ABAI_NUOT_0012	346,439
Sum		856,502

Table 4.3-2: *Polygons calculated for island section Nuotaea*

4.4 RIBO (Ribono) 2003

Figure 4.4-1: *Island section Ribono*

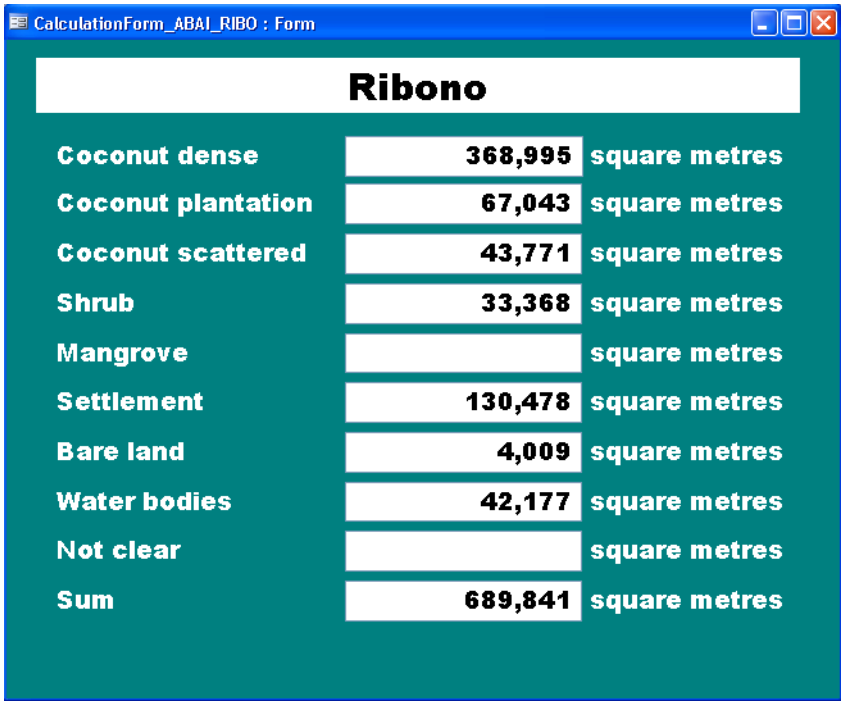


Table 4.4-1: *Area in m^2 for mapped vegetation strata of island section Ribono*

VegetationClassName	ID	Area
Water bodies	ABAI_RIBO_0001	42,177
Shrub vegetation	ABAI_RIBO_0002	13,093
Settlement	ABAI_RIBO_0003	130,478
Coconut plantation	ABAI_RIBO_0004	67,043
Coconut scattered	ABAI_RIBO_0005	10,896
Shrub vegetation	ABAI_RIBO_0006	20,275
Coconut scattered	ABAI_RIBO_0007	32,876
Coconut dense	ABAI_RIBO_0008	326,153
Bare land	ABAI_RIBO_0009	4,009
Coconut dense	ABAI_RIBO_0010	42,842
Sum		689,841

Table 4.4-2: *Polygons calculated for island section Ribono*

4.5 TEIR (Teirio) 2003

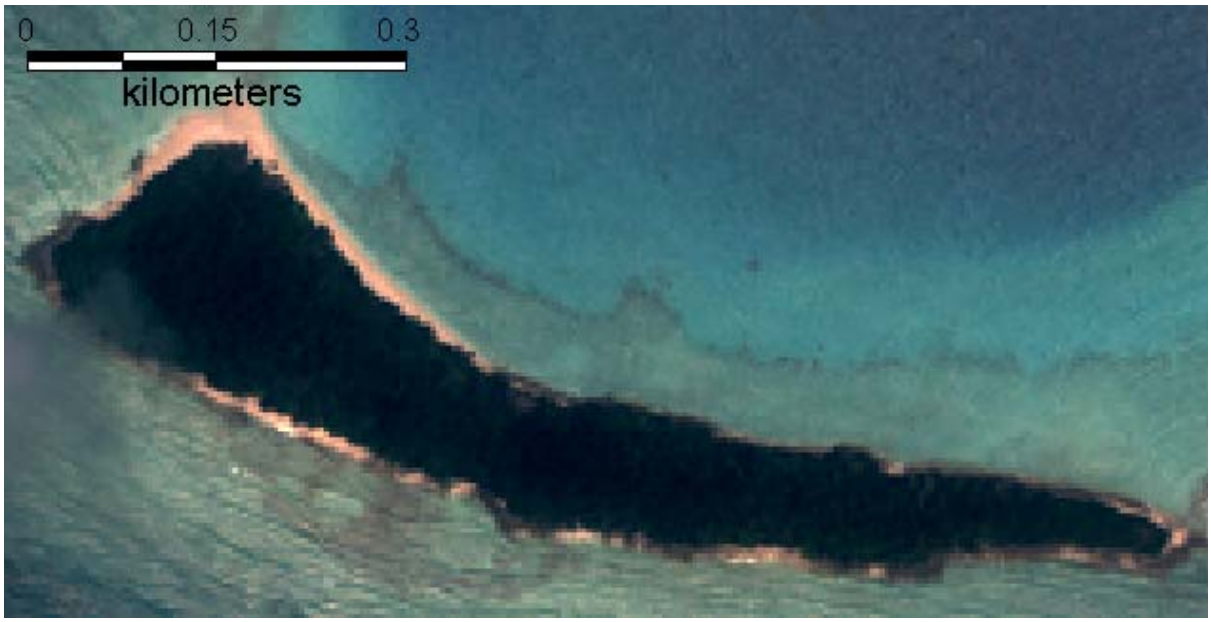


Figure 4.5-1: *Island section Teirio*

CalculationForm_ABAI_TEIR : Form

Teirio

Coconut dense	75,123	square metres
Coconut plantation		square metres
Coconut scattered		square metres
Shrub	12,909	square metres
Mangrove		square metres
Settlement		square metres
Bare land		square metres
Water bodies		square metres
Not clear		square metres
Sum	88,033	square metres

Table 4.5-1: *Area in m^2 for mapped vegetation strata of island section Teirio*

VegetationClassName	ID	Area
Shrub vegetation	ABAI_TEIR_0001	2,714
Shrub vegetation	ABAI_TEIR_0002	10,195
Coconut dense	ABAI_TEIR_0003	75,123
Sum		88,033

Table 4.5-2: *Polygons calculated for island section Teirio*

4.6 TAET (Taete) 2003

Figure 4.6-1: *Island section Taete*

CalculationForm_ABAI_TAET : Form

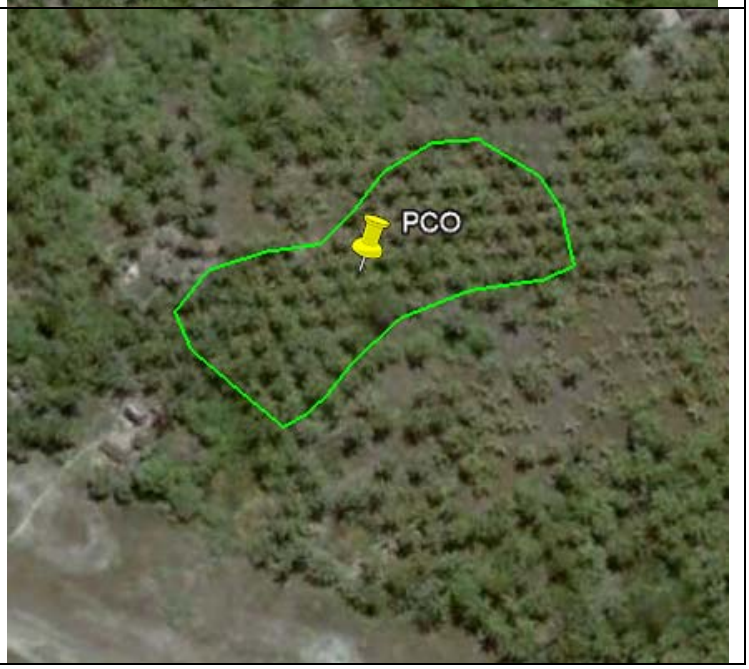
Taete		
Coconut dense	215,305	square metres
Coconut plantation		square metres
Coconut scattered		square metres
Shrub	4,890	square metres
Mangrove		square metres
Settlement		square metres
Bare land		square metres
Water bodies		square metres
Not clear		square metres
Sum	220,195	square metres

Table 4.6-1: *Area in m^2 for mapped vegetation strata of island section Taete*

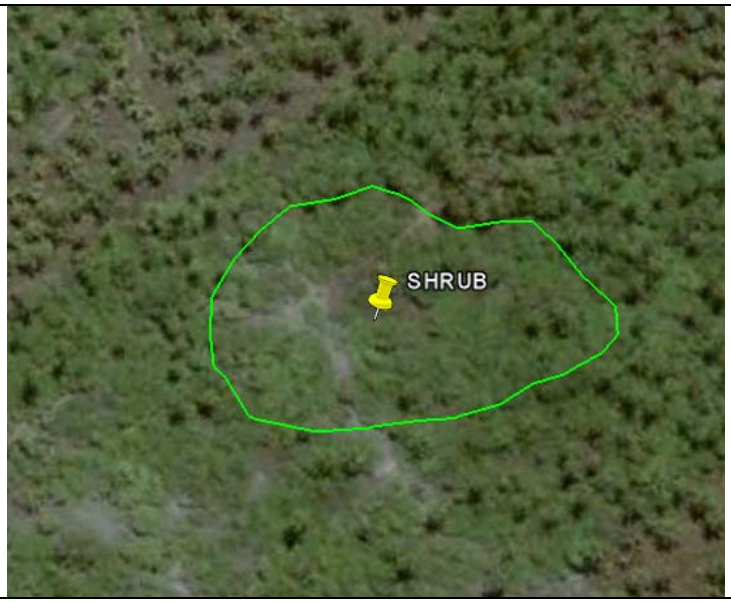
Shrub vegetation	ABAI_TAET_0001	4,890
Coconut dense	ABAI_TAET_0002	215,305
Sum		220,195

Table 4.6-2: *Polygons calculated for island section Taete*

5 Interpretation Key

Vegetation Type	Description	Interpretation Key Images
DCO (Abaiang)	Dense coconut palm is recognised by its texture. A single palm has a star like shape. DCO has 150 to 300 coconuts per hector	
PCO (Abaiang)	Coconut plantation is recognised by the systematic planting lines. PCO has 75 to 100 coconuts in an hector	

SCO (Abaiang)	Scattered coconut palm is characterised by its texture in contrast to other vegetation types. The star like texture of single palms is the dominant feature SCO has 75 and less coconuts in an hector	
BL (Abaiang)	Bare land is considered as areas where no vegetation exists. This can be caused by deforestation or through other natural processes.	

ST (Abaiang)	Settlement is defined as the buffer of 75 m around houses. The green line shows this 75 meter boundary.	
SHRUB (Abaiang)	Shrub is vegetation under 5 meters in height. It has a light green colour in visible band combination. There is not much shade that can be seen.	

WB (Abaiang)	Any form of inland water is classified as "water body". The plain dark surface without any texture identifies it. These can be ponds, lakes and swamps.	
MG (Bonriki, Tarawa)	Mangroves live at the edge of the land and grow at sea level. It can be identified by its texture like a woollen carpet. It appears darker than closed by vegetation. Mangroves grow normally at the beach and in low lying parts of islands with salt water infiltration also inland.