Progresses in the ecosystem accounting (SEEA EA) in the Cienaga Grande de Santa Marta (CGSM) Ramsar Site in Colombia (*The Great Lagoon of Santa Marta*)

7th Joint OECD/UNECE Seminar on Implementation of SEEA

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Ecosystem accounting area (EAA):
Cienaga Grande de Santa Marta (CGSM) Ramsar Site

Figure. Existing conservation figures for the CGSM RAMSAR site.
Source: Arias et al. (2021)
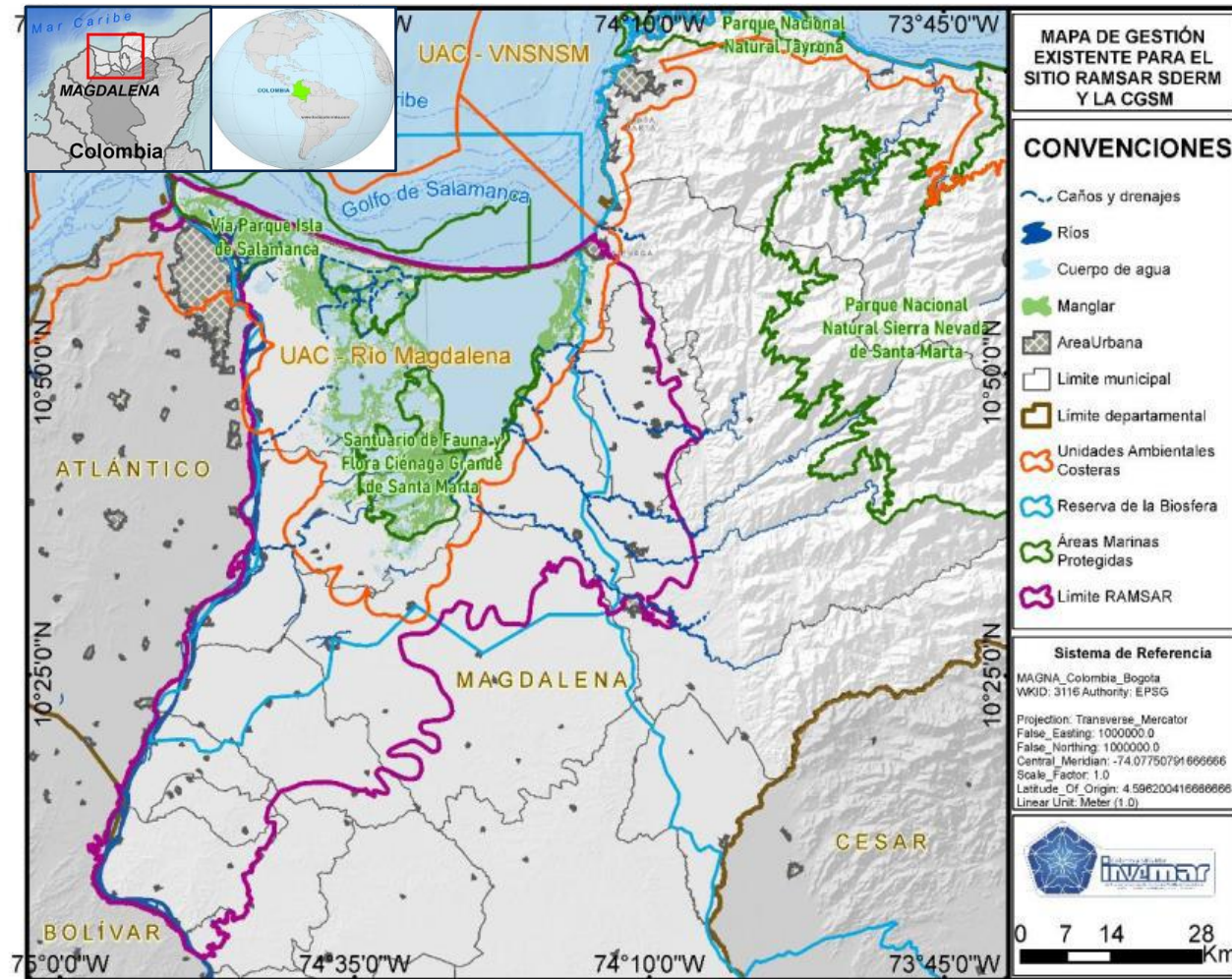
- The CGSM is located in the department of Magdalena in northern Colombia.

- It is the most important estuarine wetland in Colombia because its extension (the largest coastal lagoon) and its role in the national economy (Ramsar 2017).

- It hosts strategic marine and coastal ecosystems such as mangroves, coastal lagoons, coastal wetlands and beaches.

- Mangrove ecosystems are the most important and largest on the Caribbean coast of Colombia; also, they serve as habitats for resident and migratory birds, mammals, reptiles, molluscs and fish (Ramsar 2017).

- It is protected by five conservation figures: PNN VIPIS (1964), SFF CGSM (1977), RAMSAR Wetland (1998), Unesco Biosphere Reserve (2000) and Important Bird and Biodiversity Area (IBA/AICA) (INVEMAR 2021).

Spatial units for ecosystem accounting in the CGSM
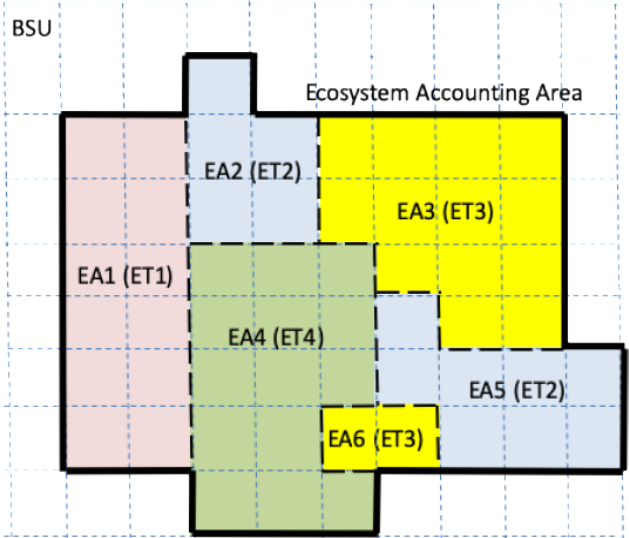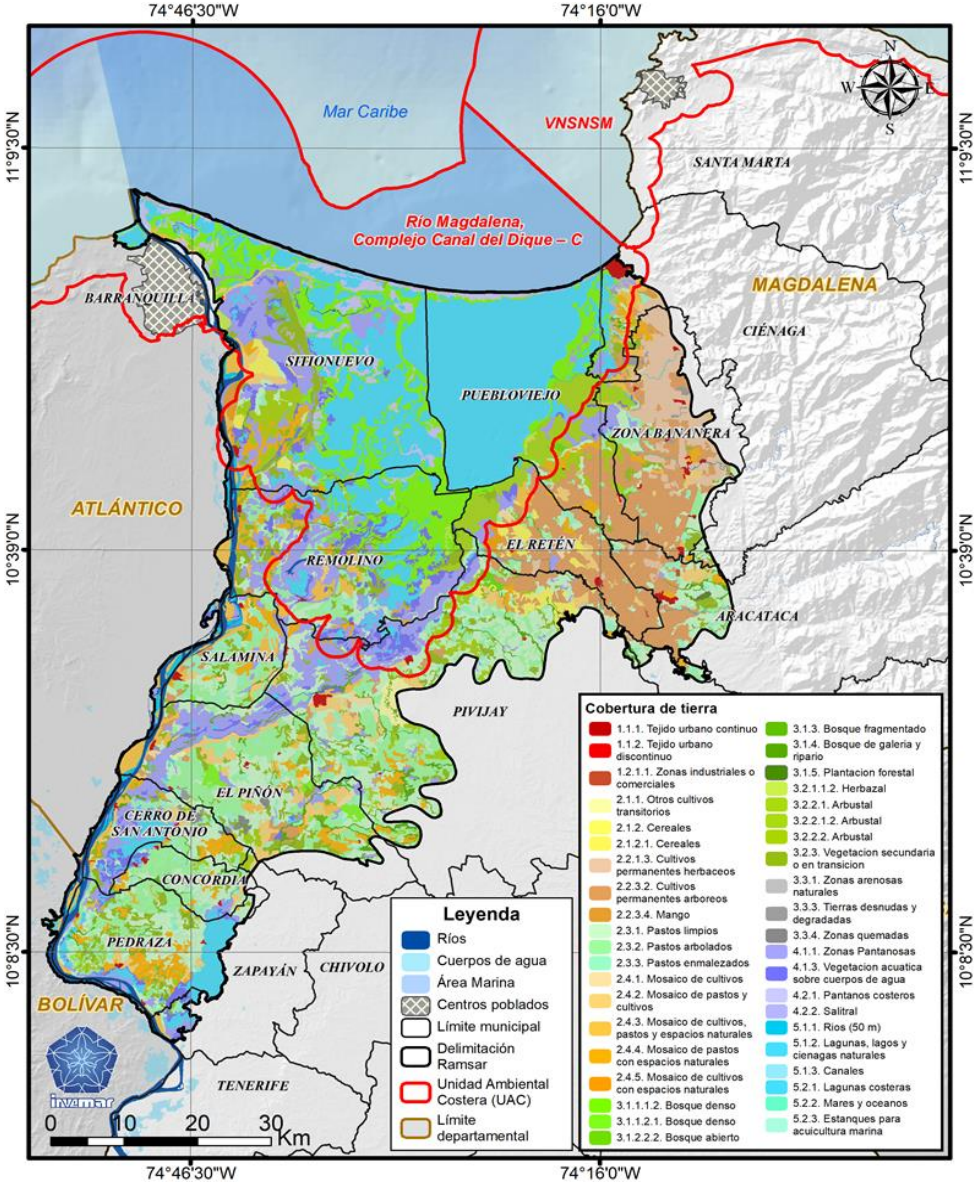
Source: United Nations et al. 2021

Types of spatial units	SEEA EA CGSM Ramsar Site
Ecosystem accounting area (EAA)	Cienaga Grande de Santa Marta Ramsar Site
Ecosystem assets (EA)	Land cover types present in the CGSM based on the National Legend of land cover adapted for Colombia (IDEAM 2010)
Basic spatial units (BSU)	Minimum mapping units: 5 ha for artificialized territories 25 ha for agricultural territories, forests and semi-natural areas, wetlands and water surfaces (IDEAM 2021)

Figure. Land cover map scale 1:100,000 of the CGSM Ramsar Site (INVEMAR & MINAMBIENTE, 2019)

SEEA Ecosystem Type Reference Classification based on the IUCN Global Ecosystem Typology

| CLC Clasification	IUCN Typology			
Corine Land Cover level 3	Biome Code	Biome	EFG	Ecosystem
5.1.1. Ríos	F1.1	Rivers and streams	F1.1	Permanent upland streams
5.1.2. Lagunas, lagos y ciénagas naturales	F2	Lakes	F2.2	Small permanent freshwater lake
5.2.1. Lagunas costeras	F2	Lakes	F2.1	Large permanent freshwater lakes
5.1.3. Canales	F3	Artificial fresh waters	F3.5	Canals, ditches and drains
4.2.1. Pantanos costeros	FM1	Semi-confined transitional waters	FM1.2	Permanently open riverine estuaries and bays
3.1.1. Bosque denso	MFT1	Brackish tidal systems	MFT1.2	Intertidal forests and shrublands
3.1.2. Bosque abierto	MFT1	Brackish tidal systems	MFT1.2	Intertidal forests and shrublands
3.1.3. Bosque fragmentado	MFT1	Brackish tidal systems	MFT1.2	Intertidal forests and shrublands
3.3.1. Zonas arenosas naturales	MT1	Shoreline systems	MT1.3	Sandy shores
3.1.4. Bosque de galería y riapario	T1	Tropical-subtropical forests	T1.2	Tropical-subtropical dry forests and thickets
3.2.1. Herbazal	T3	Shrublands & shrubby woodlands	T3.1	Seasonally dry tropical shrublands
3.2.2. Arbustal	T3	Shrublands & shrubby woodlands	T3.1	Seasonally dry tropical shrublands
3.2.3. Vegetación secundaria o en transición	T3	Shrublands & shrubby woodlands	T3.1	Seasonally dry tropical shrublands
3.3.3. Tierras desnudas y degradadas	T4	Shrublands & shrubby woodlands	T3.2	Seasonally dry tropical shrublands
1.1.1. Tejido urbano continuo	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.1.2. Tejido urbano discontinuo	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.2.1. Zonas industriales o comerciales	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.2.5. Obras hidráulicas	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.3.1. Zonas de extracción minera	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.3.2. Zona de disposición de residuos	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
1.4.2. Instalaciones recreativas	T7	Intensive land-use systems	T7.4	Urban and industrial ecosystems
2.1.1. Otros cultivos transitorios	T7	Intensive land-use systems	T7.1	Annual croplands
2.1.2. Cereales	T7	Intensive land-use systems	T7.1	Annual croplands
2.2.1. Cultivos permanentes herbáceos	T7	Intensive land-use systems	T7.1	Annual croplands
2.2.3. Cultivos permanentes arbóreos	T7	Intensive land-use systems	T7.1	Annual croplands
2.3.1. Pastos limpios	T7	Intensive land-use systems	T7.2	Sown pastures and fields
2.3.2. Pastos arbolados	T7	Intensive land-use systems	T7.5	Derived semi-natural pastures and oldfields
2.3.3. Pastos enmalezados	T7	Intensive land-use systems	T7.5	Derived semi-natural pastures and oldfields
2.4.1. Mosaico de cultivos	T7	Intensive land-use systems	T7.1	Annual croplands
2.4.2. Mosaico de pastos y cultivos	T7	Intensive land-use systems	T7.1	Annual croplands
2.4.3. Mosaico de cultivos, pastos y espacios naturales	T7	Intensive land-use systems	T7.5	Derived semi-natural pastures and oldfields
2.4.4. Mosaico de pastos con espacios naturales	T7	Intensive land-use systems	T7.5	Derived semi-natural pastures and oldfields
2.4.5. Mosaico de cultivos con espacios naturales	T7	Intensive land-use systems	T7.5	Derived semi-natural pastures and oldfields
4.1.1. Zonas pantanosas	TF1	Palustrine wetlands	TF1.1	Tropical flooded forests and peat forests
4.1.3. Vegetación acuática sobre cuerpos de agua	TF1	Palustrine wetlands	TF1.1	Tropical flooded forests and peat forests

Correspondence between the ecosystem assets (EA) present in the CGSM based on the National Legend of land cover adapted for Colombia (IDEAM, 2010) with the SEEA Ecosystem Type Reference Classification based on the IUCN Global Ecosystem Typology.

Source: Own elaboration based on: Keith et al. (2020) * IDEAM (2010) **

SEEA Ecosystem Type Reference Classification
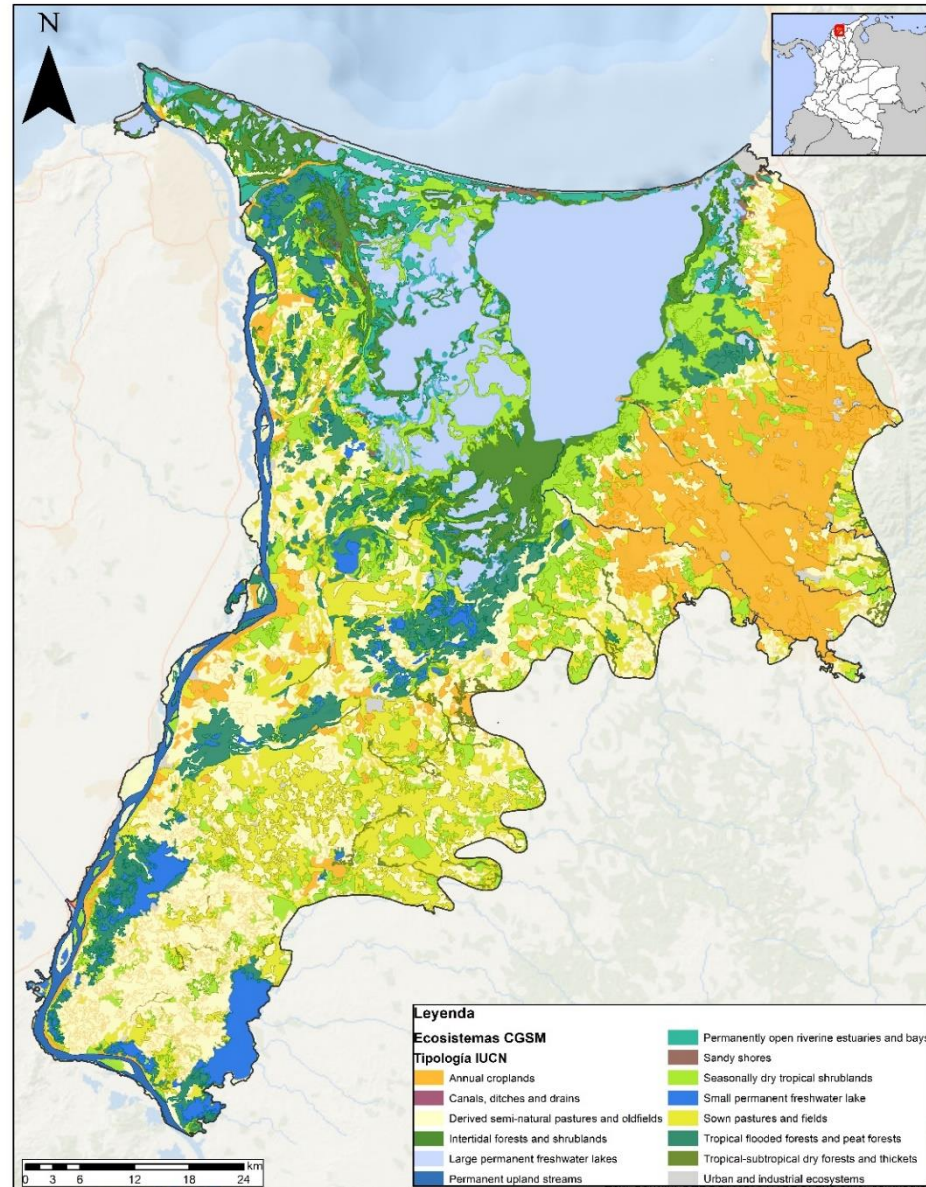
Ecosystem assets (EA) present in the CGSM Ramsar Site according to the IUCN global ecosystem typology.

Source: Own elaboration based on Keith et al. (2020).

Ecosystem extent account in the CGSM

Variables	Ecosystem accounting area (EAA): Cienaga Grande de Santa Marta Ramsar Site														
	Terrestrial											Freshwater		Marine	
	1. Territorios Artificializados				2. Territorios Agricolas				3. Bosques y Áreas seminaturales			4. Áreas Húmedas		5. Superficies de Agua	
	1.1. Zonas urbanizadas	1.2. Zonas industriales	1.3. Zonas de extracción mineras y escombreras	1.4. Zonas verdes artificializadas, no agrícolas	2.1. Cultivos transitorios	2.2. Cultivos permanentes	2.3. Pastos	2.4. Áreas agrícolas heterogéneas	3.1. Bosques	3.2. Áreas con vegetación herbácea y/o arbustiva	3.3. Áreas abiertas, sin o con poca vegetación	4.1. Áreas húmedas continentales	4.2. Áreas húmedas costeras	5.1. Aguas continentales	5.2. Aguas marítimas
Opening extent (2012)	2911	45	0	0	5177	43903	151099	62136	38674	35285	4594	55096	16818	27200	76344
Aditions to extent															
Managed expansion															
Unmanaged expansion															
Reductions in extent															
Managed reductions															
Unmanaged reductions															
Net change in extent	736,84	192,92	45,02	19,06	-3410,41	15472,49	-22919,39	1938,83	-7799,03	15850,40	10971,78	-11454,92	-3105,60	-3291,00	6445,58
Closing extent (2018)	3648	238	45	19	1767	59375	128179	64075	30875	51135	15566	43641	13713	23909	82790

Table 1. Ecosystem extent account (ha) in the CGSM Ramsar Site for the 2012 - 2018 accounting period.

Source: Own elaboration based on geographic information available on the IDEAM institutional page

Ecosystem extent account in the CGSM

Figure. Gains and losses of ecosystem assets (EA) for the accounting period 2012 - 2018. Source: own elaboration.
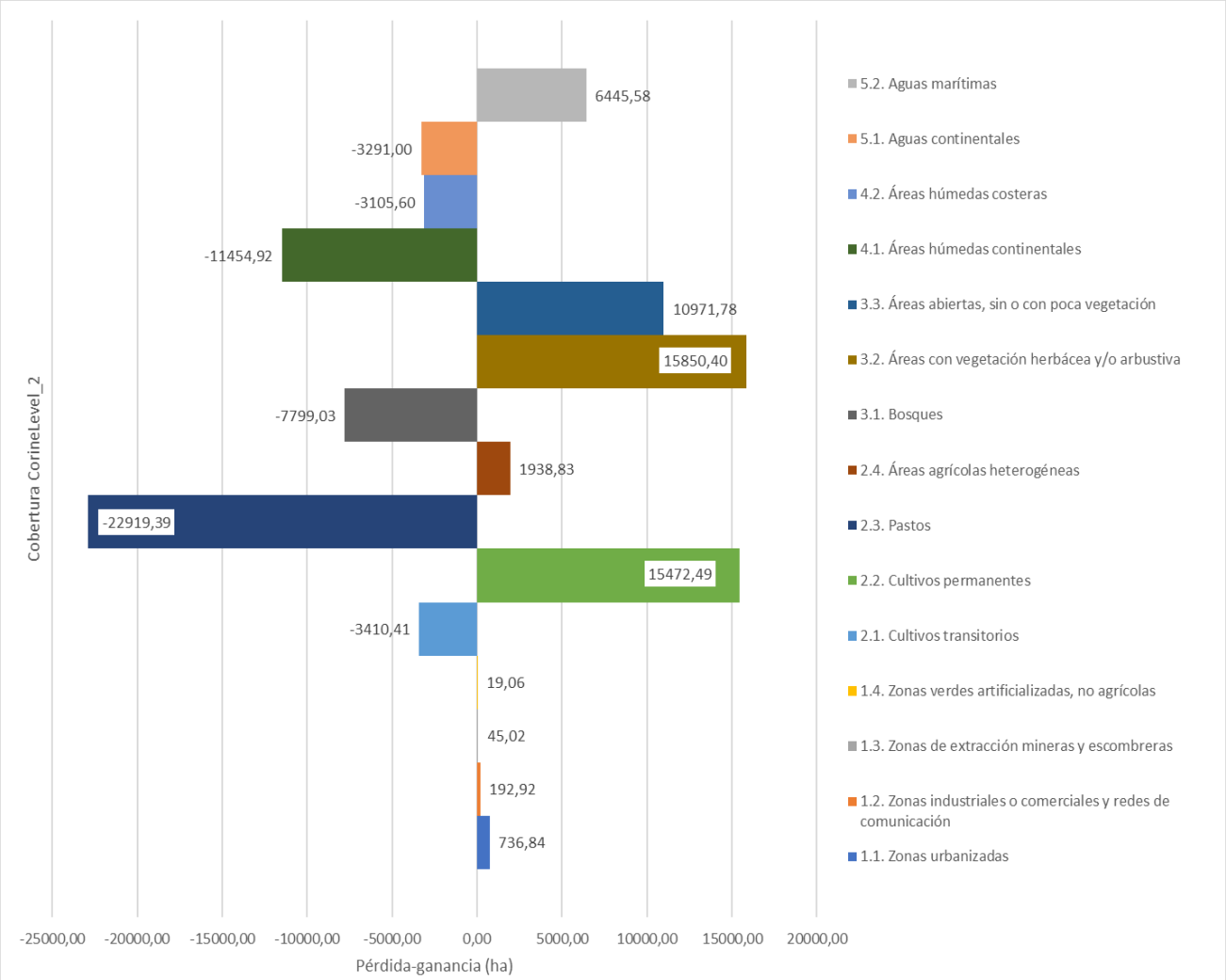
The results show that the ecosystem assets (EA) that had the greatest losses in the accounting period 2012 - 2018 were pastures, continental wetlands and mangroves.

The greatest gains were reported for annual croplands and seasonally dry tropical shrublands

Ecosystem type change matrix

Selected ecosystem types (based on Corine Land cover - Level 2)
Closing extent

CLC - Level 1	Selected EFG (CLC - Level 2)	Code	1.1. Zonas urbanizadas (T1.1)	1.2. Zonas industriales (T1.2)	1.3. Zonas de extracción mineras y escombreras (T1.3)	1.4. Zonas verdes artificializadas, no agrícolas (T1.4)	2.1. Cultivos transitorios (T1.5)	2.2. Cultivos permanentes (T1.6)	2.3. Pastos (T1.7)	2.4. Áreas agrícolas heterogéneas (T1.8)	3.1. Bosques (T1.9)	3.2. Áreas con vegetación herbácea y/o arbustiva (T1.10)	3.3. Áreas abiertas, sin o con poca vegetación (T1.11)	4.1. Áreas húmedas continentales (F1.1)	4.2. Áreas húmedas costeras (F1.2)	5.1. Aguas continentales (F1.3)	5.2. Aguas marítimas (M1.1)	Opening
1. Territorios Artificializados	1.1. Zonas urbanizadas	T2.1		0	0	0	0	118	412	122	6	1	175	28	64	4	26	2911
1. Territorios Artificializados	1.2. Zonas industriales	T2.2	2		0	0	0	87	22	28	0	0	0	0	49	2	0	45
1. Territorios Artificializados	1.3. Zonas de extracción mineras y escombrera	T2.3	0	0		0	0	0	45	0	0	0	0	0	0	0	0	0
1. Territorios Artificializados	1.4. Zonas verdes artificializadas, no agrícolas	T2.4	0	0	0		0	0	19	0	0	0	0	0	0	0	0	0
2. Territorios Agricolas	2.1. Cultivos transitorios	T2.5	2	0	0	0		403	482	142	5	69	30	0	0	13	0	5177
2. Territorios Agricolas	2.2. Cultivos permanentes	T2.6	51	0	0	0	1884		10049	5507	155	1510	6	82	0	396	0	43903
2. Territorios Agricolas	2.3. Pastos	T2.7	61	0	0	0	718	959		22005	970	3201	405	5894	98	408	16	151099
2. Territorios Agricolas	2.4. Áreas agrícolas heterogéneas	T2.8	36	0	0	0	1326	1675	0		419	4549	522	9569	444	1241	104	62136
3. Bosques y Áreas seminaturales	3.1. Bosques	T2.9	21	0	0	0	368	5	1294	797		641	103	1808	1358	249	672	38674
3. Bosques y Áreas seminaturales	3.2. Áreas con vegetación herbácea y/o arbustiva	T2.10	4	0	0	0	257	468	16048	7947	2669		260	6275	323	508	226	35285
3. Bosques y Áreas seminaturales	3.3. Áreas abiertas, sin o con poca vegetación	T2.11	0	0	0	0	0	11	1521	1010	5951	1644		1428	1681	77	760	4594
4. Áreas Húmedas	4.1. Áreas húmedas continentales	F2.1	12	0	0	0	0	0	3120	2855	1705	5841	267		1493	4256	776	55096
4. Áreas Húmedas	4.2. Áreas húmedas costeras	F2.2	3	0	0	0	0	0	9	349	1800	925	347	1468		249	1489	16818
5. Superficies de Agua	5.1. Aguas continentales	F2.3	31	0	0	0	3	440	376	1290	128	178	658	3035	440		4	27200
5. Superficies de Agua	5.2. Aguas marítimas	M2.1	3	0	0	0	0	143	10	1296	574	277		2193	3677	17257		76344
Closing			3648	238	45	19	1767	59375	128179	64075	30875	51135	15566	43641	13713	23909	82790	

Table 2. Ecosystem type change matrix (ha) in the CGSM Ramsar Site in the 2012 - 2018 accounting period.
Source: own elaboration based on geographical information available on the institutional page of IDEAM.

Condition indicators for mangroves and aquatic ecosystems

	Mangroves				Coastal lagoons			Magdalena river drains			Rivers SNSM			Marine area		
	Basal area (m² ha⁻¹)	N° PP (m² ha⁻¹)	Salin	IBIM	Oxig. (mg L⁻¹)	SST (mg L⁻¹)	Salin	Oxig. (mg L⁻¹)	SST (mg L⁻¹)	Salin	Oxig. (mg L⁻¹)	SST (mg L⁻¹)	Salin	Oxig. (mg L⁻¹)	SST (mg L⁻¹)	Salin
Condition 2017	19,7	6,3	34,1	2,35	7,26	52,5	9,8	5,48	241,8	1,3	4,1	52,0	2,1	5,75	79,7	18,7
Adittions		12,9			0,03	7,8		0,49	6,3			31,4		0,65	21,8	
Reductions	3,8		5,5	0,03							0,8					
Condition 2018	16,0	19,2	39,6	2,33	7,29	44,7	7,9	5,97	235,5	1,2	3,4	20,6	1,3	6,40	57,9	20,1
Adittions			8,2	0,05				0,44	30,2	0,6						
Reductions	1,4	1,8			0,08	2,8						8,0		0,46	7,4	
Condition 2019	14,5	17,3	31,4	2,38	7,21	47,5	11,0	6,41	205,3	1,5	4,0	28,5	4,8	5,94	65,3	22,8
	↓	↑	↑	↑	↓	↑	↓	↑	↑	↓	↑	↑	↓	↑	↑	↓

Table 3. Condition variables of mangroves and aquatic ecosystems present in CGSM Ramsar Site. Seedlings and propagules (PP), Mangrove integrity index (IBIM), dissolved oxygen (Oxig.), total suspended solids (SST), salinity (Salin), Sierra Nevada de santa Marta (SNSM). The condition of aquatic ecosystems is higher with lower concentrations of total suspended solids.

Source: INVEMAR, 2020, 2020a

Extension (ha) of mangroves in different states of condition

Extension by mangrove condition (ha)				
	Good condition	Moderate disturbance	High disturbance	Total
Extension 2018	30190,6	2097,3	2077,0	34364,9
Adittions		1815,9	565,0	
Reductions	1366,4			
Extension 2019	28824,2	3913,1	2642,0	35379,3

Table 4. Extension (ha) of mangroves in different states of condition according to the OSAVI Index - INVEMAR 2018 – 2019 accounting period.

Source: own elaboration based on INVEMAR 2019

Biophysical indicators for the valuation of ecosystem service of carbon storage

Above and below ground carbon stock (millions of tons)				Annual emissions equivalent to total stock in number of Colombians
	Edge	Basin	Total mangrove	
Initial stock 2015	0,41	13,25	13,66	25.270.262
Final stock 2017	0,40	10,21	10,62	19.638.230
Initial stock 2017	0,40	10,21	10,62	19.638.230
Final stock 2018	0,39	10,74	11,13	20.589.197
Initial stock 2018	0,39	10,74	11,13	20.589.197
Final stock 2019	0,40	11,01	11,41	21.105.090

Table 5. Carbon storage ecosystem service (millions of tons) provided by mangrove forests at the CGSM Ramsar site for the 2015 - 2019 accounting period.

Source: own elaboration based on data from Boden et al. 2009; INVEMAR 2020

Biophysical – monetary indicators for the valuation of ecosystem service of fishing

Catch (tons year⁻¹)				Monetary value of production (constant 2015 prices, average RMR 2015: 1 $USD = $COP 2743,39)
Fish	Crustaceans	Molluscs	Total	
Catch 2015				
4028,7	839,4	243,5	5111,6	3843002,4
Adittions
0,0	38,5	0,0	0,0	0,0
Reductions
530,6		2,1	494,3	276251,2
Catch 2016
3498,1	877,8	241,4	4617,3	3566751,2
Adittions
528,9	532,3	121,3	1182,5	462015,6
Reductions
0,0	0,0	0,0	0,0	0,0
Catch 2017
4027,0	1410,1	362,8	5799,9	4028766,8
Adittions
818,3	0,0	0,0	235,4	0,0
Reductions
0,0	220,1	362,8	0,0	626498,5
Catch 2018
4845,3	1190,0	0,0	6035,3	3402268,3
Adittions
0,0	179,1	0,0	0,0	335837,0
Reductions
390,3	0,0	0,0	211,2	0,0
Catch 2019
4455,0	1369,0	0,0	5824,0	3738105,3

Table 6. Fishing resources account. Total catch (tons year⁻¹) per group of organism registered in the CGSM. Monetary value of production (constant 2015 prices).

Source: own elaboration with SIPEIN data

Thank you!

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