

# QUICK SCAN COLOMBIA

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**Solidaridad**



## ACRONYMS

MADR	Ministerio de Agricultura y Desarrollo Rural
MADS	Ministerio de Ambiente y Desarrollo Sostenible
MINTIC	Ministerio de Tecnologías de la Información y las Comunicaciones
IGAC	Instituto geográfico Agustín Codazzi
IDEAM	Institutos de Investigación Ambiental: el Instituto de Hidrología, Meteorología y Estudios Ambientales
IAvH	Instituto de Investigación de Recursos Biológicos Alexander von Humboldt
INVEMAR	Instituto de Investigaciones Marinas y Costeras
SINCHI	Instituto Amazónico de Investigaciones Científicas
IIAP	Instituto de Investigaciones Ambientales del Pacífico
ANLA	Autoridad Nacional de Licencias Ambientales
ICDE	Infraestructura colombiana de datos espaciales
RICCLISA	Red Interinstitucional de cambio climático y seguridad alimentaria
DPS	Departamento para la Prosperidad Social
CIAT	International center for Tropical Agriculture- Member of CGIAR
DNP	Departamento Nacional de Planeación
ECDBC	Colombian strategy for Low Carbon
SME	Spatial Modeling Environment
PSAN	Politics of Food and Nutrition Security
PNSAN	National Plan Food and Nutrition Security
SISCLIMA	National Climate Change System
PNACC	Adaptation National Plan to Climate Change
PNIGIRH	National Policy for the Integrated Management of Water Resources
FAO	Food & Agriculture Organization of the United Nations
WMO	World Meteorological Organization
REDD++	Reducing Emissions from Deforestation and Forest Degradation
ENREDD	National Strategy for Reducing Emissions from Deforestation and Forest Degradation

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## INTRODUCTION

Within the framework of food security policy, the Ministry of Foreign Affairs of The Netherlands is implementing the programme 'Geo-data for Agriculture and Water (G4AW) Facility'. The G4AW Facility aims to increase the agricultural sector output in G4AW partner countries. This is achieved by providing food producers with relevant information, advice and/or (financial) products through operational information chains using satellite data.

In the summer of 2014, a new call for tenders will be opened. In this call, the Ministry of Foreign Affairs of The Netherlands calls for good quality project proposals from viable partnerships.

### **Goal of the Quick Scan**

The Quick Scan serves as input for preparing the country visit and the G4AW information and matchmaking workshop in Colombia. In the workshop the local context, constraints and challenges in agriculture will be discussed. Furthermore, the background and details of the G4AW Facility is provided and the development of partnerships is promoted.

This Quick Scan provides an up-to-date information assessment on agricultural and associated activities. It provides information from different perspectives and in a wider context (climate, water management). Additional, stakeholders from different types of organizations are identified and reported. The document is initially supporting the country visits and workshop, but the provided information can also contribute to the development of partnerships that are intending to bring forward a proposal in the second call of the G4AW Facility.

# 1 ASSESSMENT OF COLOMBIA WITH A FOCUS ON AGRICULTURAL ISSUES

Pressure on the agro-eco production systems caused by increased (overpopulation), climate changes and extreme weather conditions lead to a lack of natural local resilience. In this section, the most important challenges in the agro-eco systems in Colombia are given as well as an overview of (governmental) efforts to address the food security situation.

This Quick Scan is built by a compilation and research of information on the use of Information and Communication Technology - ICT - in Colombia in the field of agriculture. It describes the state of art in ICT, as the country is facing policies and strategies on food security, water management and climate change, as well as the achievements and sectoral developments in the application of ICT for information management at different levels.

Colombia overview of the potential to innovate and include within a more competitive and sustainable environment through the adoption and implementation of ICT in the development of agriculture and its capacity to generate through these tools economic growth, environmental sustainability, food security for poverty reduction and risk management regarding climate change. It also addresses the expectations in the field of agriculture, that are combined with governmental institutions, private sectors and organizations; efforts to reduce the social, economic, cultural and technological gaps, in order to adapt and involve information systems on productivity cycle. Regarding data about climate conditions and variability, it's necessary to connect with food availability, water resources and risk management alerts to be able for decision-making.

## 1.1 MAIN CHALLENGES IN COLOMBIAN AGRO-ECO SYSTEMS

Colombia is the fourth largest country in South America and the only one with Caribbean and Pacific coasts. There are five main natural regions on the mainland: Caribbean, Andean, Pacific, Orinoquia and Amazonia. The vegetation cover in Colombia determined a wide diversity of ecosystems, which have been attributed to geological and geomorphologic factors, as well as the location of the country in the equatorial zone and the variety of soils and climates.

Colombia Land distribution <sup>1</sup>	Hectares (miles)	%
Total Area	207,040,800	100%
Continental Area	114,174,800	55%
Forests use*	55'939.500	49%
Other*	12'834.200	11.20%
Agricultural use*	5'317.900	4.70%
Livestock use*	40'083.200	35.10%
Conservation – protected	17.200.000	15%
Continental Water	95,866,000	46%
Pacific ocean	33,930,000	35%
Caribbean ocean	48,936,000	51%

TABLE 1.1: GENERAL CHARACTERISTICS<sup>1</sup>

Because, of those microclimates and land distribution biodiversity in Colombia is wide and rich (54.187 species), having the first place in birds species, the second place in plants and amphibians, third in reptiles and fourth in mammals. Colombia has the 14% of flora and fauna of the planet<sup>2</sup>. The incorporation of large areas of the country to agricultural and livestock production has been remarkable; however, such changes do not always conform to the biophysical characteristics and soil vulnerability implicit (Ministry of Agriculture, Restrepo, J., 2010). The potential

<sup>1</sup> Source: <http://unfccc.int/resource/docs/natc/colncl.pdf>

<sup>2</sup> Source: <http://www.sibcolombia.net/web/sib/cifras>

land for agriculture is not efficiently used, only 36% is cultivated. However, in livestock the potential area is overused in two times the area<sup>3</sup>.

**Geography and Climate**

Colombia has a total area of 207'040.800 hectares, of which 114'174.800 are continental land mass and 95'866.000 are territorial waters. The island zones consist of a series of islands in the Pacific (Malpelo and Gorgona) and in the Caribbean (archipelago of San Andres, Providence and Santa Catalina), and a large number of keys, islets and shallows). Pacific waters cover 33'930.000 hectares and Caribbean waters 48'936.000 hectares. This makes Colombia the fourth largest country in South America and the only one with Caribbean and Pacific coasts. There are five main natural regions on the mainland: Caribbean, Andean, Pacific, Orinoquia and Amazonia.

The greater part of the country enjoys more or less the same temperature ranges of an annual average of 24-28°C in the eastern zone of the Caribbean plains and a strip of the Pacific coast.

Average annual temperatures of over 28°C are to be found in the lower, middle and part of the upper Magdalena valley. In a much smaller area, including Andean and Interandean zones, there are a variety of thermal levels due to the wide variations of air temperature at higher altitudes. The snow line, with temperatures lower than 0°C, is found above 4.600 m above sea level, and is the smallest of the land areas of Colombia.



FIGURE 1.1: OVERVIEW FACT & FIGURES COLOMBIA<sup>7</sup>

<sup>3</sup> Source: <http://www.fao.org/docrep/007/j4192s/j4192s06.htm>

<sup>4</sup> Source : <http://web.presidencia.gov.co/asiescolombia/mapapolitico.pdf>

<sup>5</sup> Source : <http://www.historiacocina.com/paises/articulos/gastrocolombia.htm>

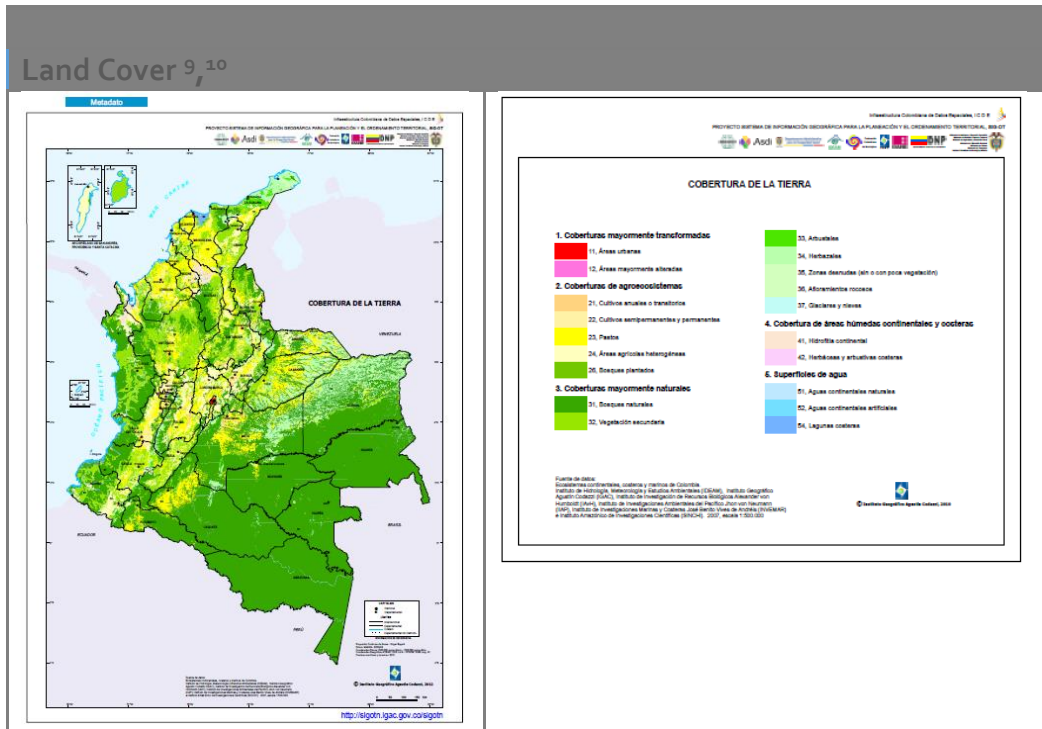
<sup>6</sup> Source : <http://sigotn.igac.gov.co/sigotn>

<sup>7</sup> Source: <http://unfccc.int/resource/docs/natc/colnc1.pdf>

**Vegetation cover, ecosystems and biodiversity**

Forests are estimated to account for 63,886.012 hectares, non-forest vegetation for 20,618.423 hectares, continental waters for 238.867 hectares, human settlements for 124.532 hectares and farming and settlement processes for 29,090.731 hectares<sup>8</sup>.

These categories of vegetation cover contain a wide diversity of ecosystems, which have been attributed to geological and geomorphologic factors, water, soil and relief, as well as the location of the country in the tropical zone and the variety of soils and climates.



<sup>8</sup> Source: <http://unfccc.int/resource/docs/natc/colnc1.pdf>

<sup>9</sup> Source: <http://sigotn.igac.gov.co/sigotn>

<sup>10</sup> Source: <http://sigotn.igac.gov.co/sigotn>



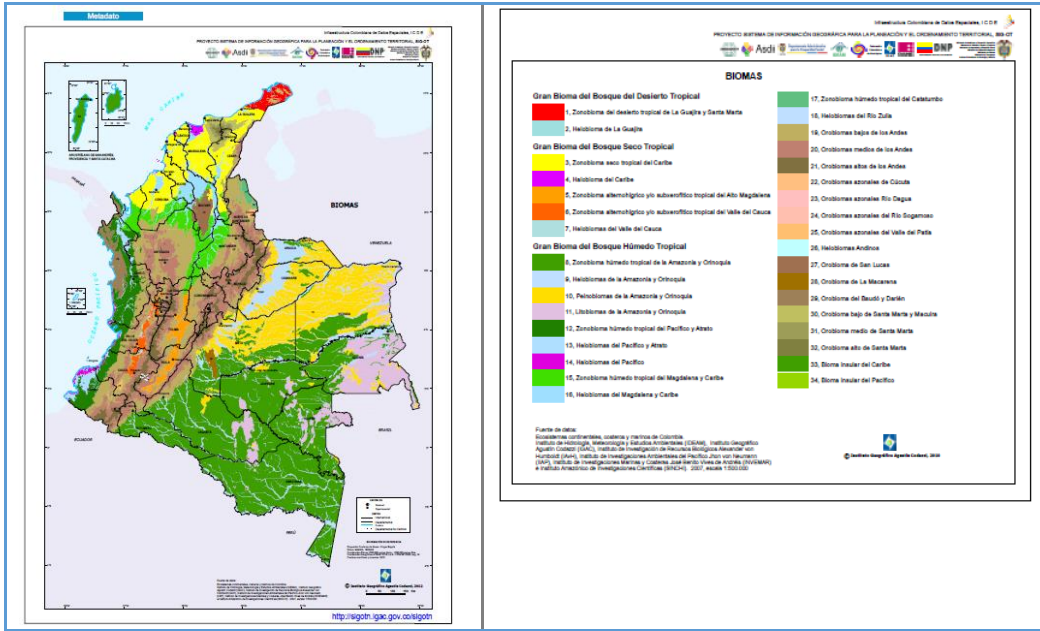


FIGURE 1.2: LAND COVER

**Most representative products of the Colombian economy**

The agricultural sector, which, despite the historical decline in recent years, still has a high share in aggregate output in the country with products such as are coffee (fourth-largest producer of coffee in the world), cut flowers, bananas, rice, tobacco, corn, sugarcane, cocoa beans, oilseed, vegetables, fique, panela, forest products; and shrimp<sup>11</sup>.

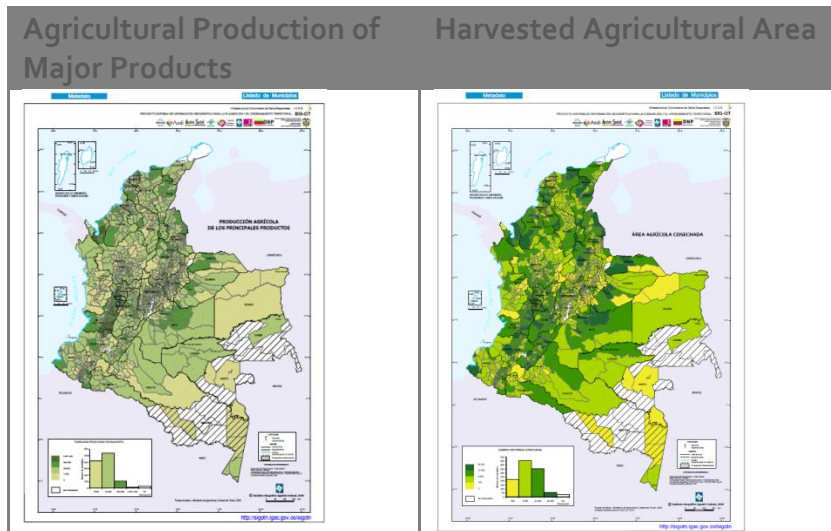


FIGURE 1.3: AGRICULTURAL INFORMATION<sup>11</sup>

<sup>11</sup> Source: <http://sigotn.igac.gov.co/sigotn>

Agricultural Problems				
Variable	Increase / Decrease	Line		Impact
EXCHANGE RATE	-	Average appraisal	2.7%	Less growth
COSTS	-	Increased farmer IPP costs, average	7.3%	Less income
PRICES	-	Fall IPP agricultural production, average	-5.8%	Less income
CONTRABAND	+	Raw materials	300 Ton	unfair competition, health problems
INFRASTRUCTURE	=	Low availability of irrigation infrastructure, storage, transportation and logistics, public service	----	Less growth
GETTING LOW FINANCING AND COVERAGE	-	Of the total credit from the formal financial system is placed in the agricultural sector	4%	Less growth
RESEARCH AND TECHNOLOGY TRANSFER	=	Little innovation and adoption in agricultural production sistemas	----	Low productivity and competitiveness
AGRICULTURAL HEALTH	-	Lower technical and administrative capacity of the country's health institutions	----	Health risks and limits access to markets
MARKETING	-	Minimum bargaining power producer in the domestic remarketing. Limited export basket	----	Low income. Poor use external market
HUMAN CAPITAL	-	Low fitness training and human capital in the sector	----	Less quality of life, competitiveness of income.

TABLE 1.3: AGRICULTURAL PROBLEMS<sup>12</sup>

### Land use in Colombia

In relation to land use and land in Colombia are multiple and change continuously. The incorporation of large areas of the country to agricultural and livestock production has been remarkable; however, such changes do not always conform to the biophysical characteristics and soil vulnerability implicit (Ministry of Agriculture, Restrepo, J., 2010)

As a reference, at the end of the nineties, from 114.17 million hectares having Colombia, were intended for agricultural uses 50.91 million hectares (44.6 %) and the rest of the non -agricultural purposes. According to the Ministry of Agriculture for the year 2010, only 4.9 million hectares of crops, 38.5 million hectares in livestock and only 350 hectares in other agricultural activities are used. For a total of 43.7 million hectares.

The problem underlying this land use is their vocation. The use of soil does not match the ability of the same and hence the impacts of this use are unpredictable and consequences on a variety of ecosystem services.

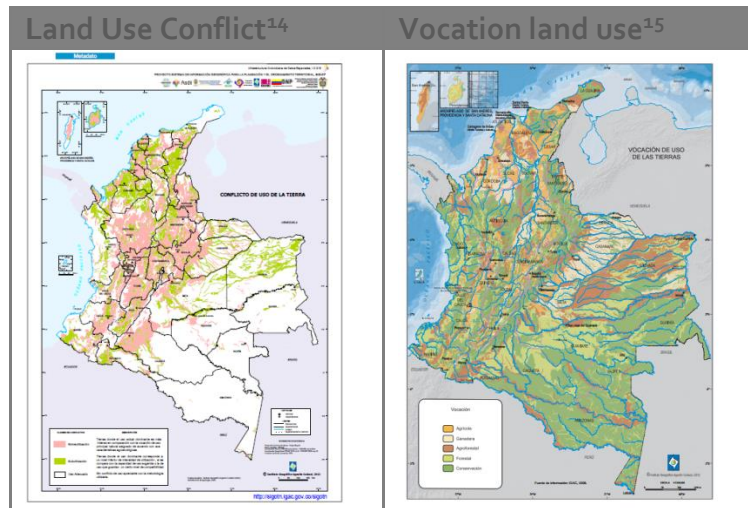
I mean in some cases the productive capacity of soils and other natural underutilized capacity is exceeded and thus degrade, and are presented conflicts over land use and its consequences with them, desertification, degradation, etc.

<sup>12</sup> Source: <http://www.sac.org.co/es/estudios-economicos/documentos-presentaciones-agropecuaria.html> (Adaptación)

Land use in Colombia Use	Surface (million hectares)	% National Area
The total land area	114.17	100
Intended for agricultural use	50.9	44.6
Forest reserves	51.3 Include urban areas, disturbed areas, and about 6 million hectares of non-forest	45
Protected Areas	17.2 Most within forest reserves, which make up the National System of Protected Areas - SINAPs	14.9
	Under the responsibility of the Special Administrative Unit of National Parks 12.723.125	11.14
	Regional Protection Areas	3.2
	Areas of local protection	0.4
	National Forest Reserves	0.4
Receipts Indigenous Territories Collective Black Community	30.5 The 70% is in forest reserves	27
	5.2 The 71% is in forest reserves	5
Holdings of non-renewable resource	5.8 There mining applications in many of the areas occupied by the agricultural frontier	5.1
Agricola use	4.9 60% in permanent crops 33% in annual crops 7% forest	4.3
Livestock	38 Currently are intended for livestock, only 19.3 million livestock have vocations	33.3
Unlawful crops	0.068(2009)	0.005

[http://eeas.europa.e/delegations/colombia/documents/projects/cartilla\\_tierra\\_y\\_desarrollo\\_lab\\_paz\\_iii\\_es.pdf](http://eeas.europa.e/delegations/colombia/documents/projects/cartilla_tierra_y_desarrollo_lab_paz_iii_es.pdf)

TABLE 1.4: LAND USE IN COLOMBIA<sup>13</sup>



<sup>13</sup> Source: <https://www.siac.gov.co/contenido/contenido.aspx?catID=832&conID=1301>

<sup>14</sup> Source: <http://sigotn.igac.gov.co/sigotn>

<sup>15</sup> Source: [http://geoportal.igac.gov.co/mapas\\_de\\_colombia/IGAC/Tematicos2012/VocacionUsoTierras.pdf](http://geoportal.igac.gov.co/mapas_de_colombia/IGAC/Tematicos2012/VocacionUsoTierras.pdf)

FIGURE 1.4: LAND USE (CONFLICTS)

In some cases the productive capacity of soils and other natural underutilized capacity is exceeded and thus degrade, and are presented conflicts over land use and its consequences like desertification and degradation. Colombia, needs to plan the land use and its potential in products. In Colombia, most representative sectors are, construction, social, community and personal services, agricultural, mining and quarrying, electricity, gas and water<sup>16</sup>. In 2013 the GDP of the agricultural sector reported an annual growth of 5.2%, with 0.9 percentage points above the total GDP (4.35). The agricultural sector was the third fastest growing relative to the total economy.

Regarding the distribution, livestock and hunt production with crops and agricultural products, represented 85% of agricultural GDP, coffee 10% and forestry 5% of agricultural GDP.

Land Use	Small Holders	Medium	Large
Coffee	95%	4%	1%
Rice	40%	40%	20%
Palm Oil	30%	30%	40%
Banano	30%	30%	40%
Flowers	10%	20%	70%
Sugar Cane		20%	80%
Sugar Cane* <i>Panela</i>	80%	10%	10%
Fruits	55%	25%	20%
Vegetables	85%	10%	5%
Livestock -Meat	45%	30%	25%
Livestack - Dairy	60%	20%	20%
Forestry			100%
Rubber	15%	15%	70%

TABLE 1.5: OVERVIEW HOLDERS AND LAND USE

### Situation of Small Holders Farmers

For food security, small holders are the leading actors in the production chain. However those farmers have cultural factors or traditional information to manage the crops, their educational level are limited and restricted knowledge to organize and work as groups in cooperatives. This situation creates challenge in marketing the products and in monitoring the quality of the crops. Regarding the community the challenges are from aging tree/plantation up to the low capacity, none generational relief, and skills of farmers.

### Infrastructure

Agricultural areas in Colombia are located spread in the entire mainland with limited infrastructure such as roads,

<sup>16</sup> Source: [http://www.dane.gov.co/files/investigaciones/boletines/pib/presen\\_PIB\\_IVtrim13.pdf](http://www.dane.gov.co/files/investigaciones/boletines/pib/presen_PIB_IVtrim13.pdf)

market access and bank services. Moreover in terms of ICT, Colombia has been improving the connectivity, though the rural areas are still away from internet access or mobile connection.

**Access to market information**

There are some platforms and online data that is available but there is not yet any evidence that the information is used by farmers at grassroots level. Usually, the intermediaries that carried the products to wholesalers manage market prices.

**Finance & Insurance**

Many municipalities of rural areas could have access to banks – Banco Agrario. MADR seek to increase the productive alliances and agricultural credits to improve farm capacity and increase productivity. However, the risk of the activity and guarantee of the harvest, limit the coverage. In Colombia, there are not micro insurance products for small holders.

## 1.2 GOVERNMENTAL EFFORTS AND POLICY ON FOOD SECURITY

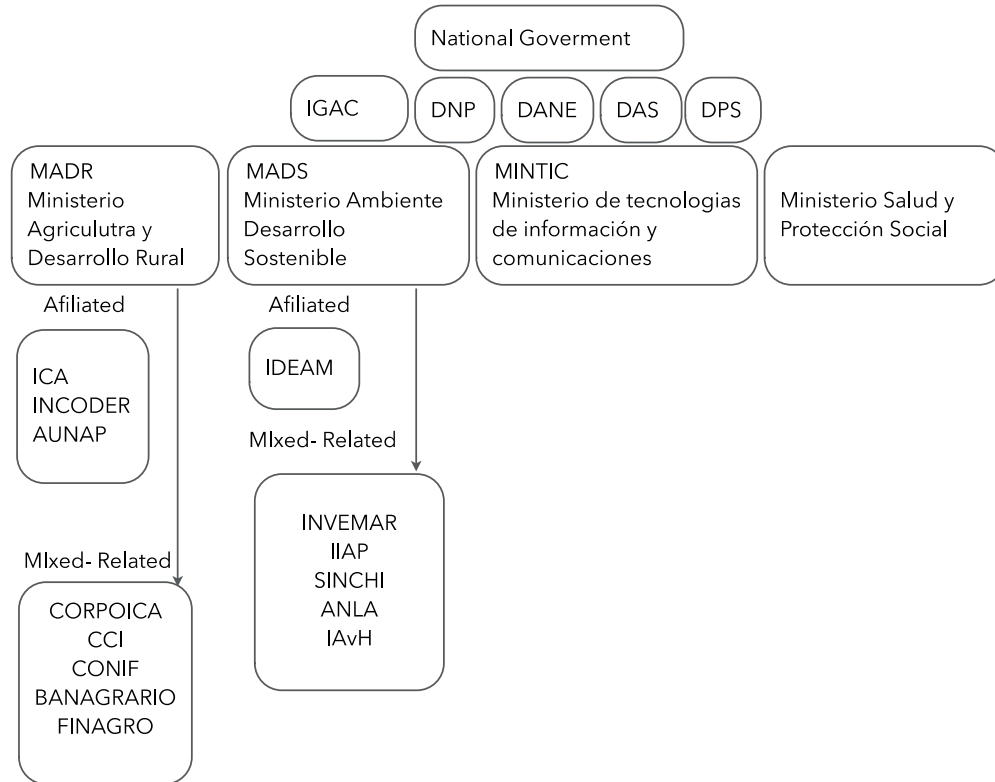


FIGURE 1.5: ORGANIZATIONAL STRUCTURE COLUMBIAN GOVERNMENT

The Colombian government is “recently developing a new agricultural policy called “Towards a new Colombian countryside: rural comprehensive reform.”<sup>17</sup>This as a result of the peace process with the FARC and with that the reformation of the countryside in Colombia. This comprises the following relevant topics:

- Access and use of land;
- Assessment and evaluation of (Un)productive land;
- Formalization of property (cadastral improvement and reform);
- Agricultural frontier areas and protection of (natural and eco-) reserves;
- Software development with a territorial approach;
- Infrastructure and land improvement;
- Social development: health , education, housing , poverty eradication;
- Stimulating agricultural production and economic solidarity and cooperative support;
- Subsidies & (micro-) credits strategy, income generation, market development, labour formalization, etc.;
- Food and nutrition policies.

<sup>17</sup> Publication in LaPluma.net, 26 May 2013,

[http://www.lapluma.net/es/index.php?option=com\\_content&view=article&id=4849:farc-y-gobierno-logran-acuerdo-en-tema-agrario-comunicado-conjunto-16&catid=119:proceso-de-paz&Itemid=493](http://www.lapluma.net/es/index.php?option=com_content&view=article&id=4849:farc-y-gobierno-logran-acuerdo-en-tema-agrario-comunicado-conjunto-16&catid=119:proceso-de-paz&Itemid=493)

This agreement will be the start of radical transformations of the rural and agricultural reality of Colombia with equity and democracy. It focuses on people, small farmers, access and distribution of land, combating poverty, stimulating agricultural production and reviving the economy of the country.

In this process, land evaluation is the basis for sound conditions for new agricultural land use in the future. One of the important aspects is the availability of water, besides other relevant conditions as soil, fertility, climate conditions in general, ownership, local markets, etc. In an integrated approach the land use reform is a multi-disciplinary process wherein the relation water and agriculture is where Dutch knowledge could support.

Related to agriculture the National Water policies concerning Water related risks and the need for reduction have strengthened the bilateral contacts with the Netherlands, since 2012 and resulted in increasing cooperation between Holland and Colombia. Since then various projects and missions have been initiated and conducted by Dutch and Colombian to visit one another and learn from each other on water management, engineering, governance<sup>18</sup>, etc.

Recent strikes in the agro sector of Colombia are due to recent developments on high prices of inputs due to the governments TLC (Free commercial trade agreements) where these high prices lead to poor position of the Colombian agriculture producers. Despite the fact that the Colombian Government had promised to support the agri sector (investments by the law 1133, 2007 DRE programma desarrollo rural con equidad), the investments are not yet implemented to improve the competitiveness of agri sector for small and medium producers (500.000 M pesos/year) by introducing microcredits and production improvement incentives.

### **Food Security Policy**

Colombia, more than three decades ago began to design and implement strategies for food and nutrition, with a focus on humanitarian aid and subsidies granted by various agencies, with the purpose site to favor the poorest families. In 2008 was created Conpes 113, national policy on Food Security and Nutrition- was made to guarantee that all Colombian population, disposed, access, and consume food in timely basis, in sufficient quantity, variety, quality and safety. This policy is reinforced by the commitments made in the "World Food Summit" which reaffirms the commitments of the World Food Summit of 1996 for the achievement of the Millennium Development Goals (MDGs)<sup>19</sup>. The policy axes address the issues by three dimensions:

1. Economic dimension: Access and availability of food;
2. Life quality and welfare (ability of people to transform food): consumption, harvesting and use of biological components of food;
3. Quality and safety of food.

That policy is updated for the period of 2012-2019 with a National Plan on Food Security and Nutrition<sup>20</sup>. The plan looked to achieve the integration, articulation and coordination of various inter-sectoral and inter-agency interventions<sup>21</sup>. It also looks forward to have precision data, in terms of information systems with the MADR of food crops availability, nutritional factors and stability of production.

### **Climate Change Policy**

Climate change is a reality, and has important effects on the socio-economic development of the country. In response to this problem, the National Government of Colombia has developed the National Plan for Adaptation to

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<sup>18</sup> For water governance and market scans see: <http://www.watergovernancecentre.nl/Publikaties/>

<sup>19</sup> Source: [https://www.minagricultura.gov.co/Normatividad/Conpes/conpes\\_113\\_08.pdf](https://www.minagricultura.gov.co/Normatividad/Conpes/conpes_113_08.pdf)

<sup>20</sup> Source: [http://infoagro.net/programas/seguridad/politicas/RegionAndina/Colombia\\_plan.pdf](http://infoagro.net/programas/seguridad/politicas/RegionAndina/Colombia_plan.pdf)

<sup>21</sup> Source: <http://www.osancolombia.org/doc/pnsan.pdf>

Climate Change (PNACC), which seeks to reduce the risk and socio-economic impacts associated with the climate change and variability<sup>22</sup>. The plan has different strategic lines as work guide:

- Raise awareness about climate change;
- Generate information and knowledge to measure climate risk;
- Plan land use;
- Implement adaptation actions;
- Strengthen resilience.

These initiatives are articulated through the government strategy in Conpes 3700 – National System of Climate Change- SISCLIMA, that seek to articulate policies and actions on climate change in Colombia. Additionally, it should permeate the highest levels of decision-making in each of the sectors and communities. SISCLIMA framework will implement actions on:

- Colombian strategy for Low Carbon Development.
- Strategy for reducing emissions from deforestation and forest degradation in developing countries, the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.
- Financial strategy for disaster protection.

#### **Water Policy**

Policy for Integrated Water Resource Management emerges as the culmination of a series of initiatives from the Ministerio de Ambiente y Desarrollo Sostenible - MADS, to establish unified water management guidelines in the country, which also aim to solve the current problems of water resources, allow to make efficient use of the resource and preserve it as a natural wealth for the welfare of future generations of Colombians.

Specifically the policy arises from the provisions of the national development plan for 2006 -2010; an environmental risk management and promoting sustainable development was incorporated as line of action, that become the integrated water resource management (IWRM). This component poses the challenge of ensuring the sustainability of the resource, derived from the hydrological cycle and the interrelations between different natural and anthropogenic components<sup>23</sup>.

This policy developed a comprehensive management of the risks associated with the supply and availability of water through mitigation measures and adaptation to reduce the risks associated to hydric offer phenomena resulting from climate variability and climate change. Through this policy to search ensure the sustainability of the resource by:

- Efficient and effective use, articulated the system and land use;
- Conservation of ecosystems that regulate the hydric offer.

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<sup>22</sup> Source: [http://www.sigpad.gov.co/sigpad/archivos/ABC\\_Cambio\\_Climatico.pdf](http://www.sigpad.gov.co/sigpad/archivos/ABC_Cambio_Climatico.pdf)

<sup>23</sup> Source: [http://www.minambiente.gov.co/documentos/5774\\_240610\\_libro\\_pol\\_nal\\_rec\\_hidrico.pdf.pdf](http://www.minambiente.gov.co/documentos/5774_240610_libro_pol_nal_rec_hidrico.pdf.pdf)



PLANS , POLICIES AND STRATEGIES IN NATIONAL FOOD SECURITY AND CLIMATE CHANGE	
<b>NATIONAL DEVELOPMENT PLAN 2010 – 2014</b> <sup>24</sup>	<p>Among its strategic lines the sustainable development and in particular climate change contemplating the next aspects:</p> <p>Implement the National Policy on Climate Change</p> <p>Shaping The National Climate Change System for strengthen information management and financial management for attend and implement projects and programs of mitigation and adaptation.</p> <p>Identify and prioritize adaptation measures to the climate change, from the analysis of vulnerability in the Framework of the National Plan for Climate Change Adaptation based on a financial strategy that includes national resources and international cooperation resources.</p>
<b>NATIONAL PLAN FOOD AND NUTRITION SECURITY 2012 -2019</b> <sup>25</sup>	<p>It is the set of objects, goals, strategies and actions proposed by the Colombian State, within a framework of core responsibility with society civil, which is to:</p> <p>Protect the population of the contingencies that entail to undesirable situations and socially inadmissible as hunger and inadequate alimentation.</p> <p>Ensure the population's access to food in a timely, appropriate and quality manner.</p> <p>Achieve the integration, articulation and coordination of various inter-sectorial and inter-agency interventions.</p>
<b>SISCLIMA - NATIONAL CLIMATE CHANGE SYSTEM</b> <sup>26</sup>	<p>Is institutional framework responsible for mobilizing and channeling resources to the implementation of actions and measures for adaptation and mitigation of climate change. Its purpose is to coordinate , harmonize and ensure complementarity, regarding to the responsibilities of public and private persons, in the at national, regional and local instances and their interrelation at international level, in order to prepare to country for the challenges and opportunity generated as result of climate change and make meaningful decisions that integrate risk management , managing the impacts of climate change, mitigation of greenhouse gases and sectorial and territorial planning actions implementing actions: National Adaptation Plan Climate , Colombian Strategy for Low Carbon Development Rates. National Strategy for Reducing Emissions from Deforestation and Forest Degradation in developing countries and Strategy Financial Disaster Protection.</p>
<b>COLOMBIAN STRATEGY LOW CARBON DEVELOPMENT</b> <sup>27</sup>	<p>Is a program of development planning in to short, medium and long term , led by the Ministry of Environment and Sustainable Development ( MADS ) , through the Direction of Climate Change, supported by the National Planning Department ( DNP ) , and Sector Ministries of Colombia , which seeks to decouple the growth of greenhouse gas emissions (GHG ) of national economic growth . This will be done through the design and implementation of plans, projects and policies aimed at mitigating GHG and simultaneously strengthen the social and economic growth of the country, in compliance with global standards of efficiency, competitiveness and environmental performance. The sectors that are involved in ECDBC Industry, Energy, Mining, Transportation, Housing, Waste and Agriculture. The Colombian Strategy for Low Carbon Development , along with the National Plan for Adaptation to Climate Change, REDD + National Strategy and the Strategy for Financial Disaster Protection were the four actions prioritized by the National Development Plan 2010-2014 , to tackling climate change.</p>
<b>NATIONAL STRATEGY REDD +++</b> <sup>28</sup>	<p>The Government of Colombia , as part of the preparatory work to develop activities for Reducing Emissions from Deforestation and Forest Degradation, conservation of forest carbon</p>

<sup>24</sup> Source: [www.dnp.gov.co/PND/PND20102014.aspx](http://www.dnp.gov.co/PND/PND20102014.aspx)

<sup>25</sup> Source: <http://www.osancolombia.org/doc/pnsan.pdf>

<sup>26</sup> Source: [http://www.sigpad.gov.co/sigpad/archivos/ABC\\_Cambio\\_Climatico.pdf](http://www.sigpad.gov.co/sigpad/archivos/ABC_Cambio_Climatico.pdf)

<sup>27</sup> Source: <http://www.minambiente.gov.co/contenido/contenido.aspx?catID=1366&conID=8884>

<sup>28</sup> Source :

[http://www.minambiente.gov.co/documentos/documentosGestion/cambio\\_climatico/publicaciones/230812\\_cartilla\\_redd.pdf](http://www.minambiente.gov.co/documentos/documentosGestion/cambio_climatico/publicaciones/230812_cartilla_redd.pdf)

	<p>stocktaking, sustainable management of forests and enhancement inventory of forest carbon stocks ( REDD + ) , including participation in a future system of financial incentives for REDD + , it is developing the proposal preparation ( R -PP) for the National REDD + Strategy, which is a roadmap to the preparation for achieving ENREDD + and in that sense , indicates which activities can be performed and provides a guide to how these activities can be performed and what resources will be needed . The ENREDD + is part of the action on Climate Change provided in the National Development Plan 2010 -2014 , for preparation are being developed actions through the Partnership Facility Forest Carbon Partnership Facility (FCPF ), the UN Programme REDD + , International Cooperation and the budget national.</p>
<p><b>CONPES 113 – 2008 NATIONAL FOOD AND NUTRITION SECURITY</b> <sup>29</sup></p>	<p>Guarantee that all Colombian population, disposed, access, and consume food ongoing and timely basis, in sufficient quantity, variety, quality and safety. The policy is the result of a process of participation and concentration between entities of national, departmental and municipal levels, with civil society organizations, international agencies, universities and guilds, among others, and therefore constitutes a state policy. The policy is part of the National Development Plan and is reinforced by the commitments made in the "World Food Summit" which reaffirms the commitments of the World Food Summit of 1996 for the achievement of the Millennium Development Goals (MDGs).</p>

TABLE 1.6: PLANS, POLICIES AND STRATEGIES FOR INTERNATIONAL FOOD SECURITY AND CLIMATE CHANGE

PLANS , POLICIES AND STRATEGIES IN MANAGEMENT OF WATER RESOURCES	
<p>NATIONAL POLICY FOR THE INTEGRATED MANAGEMENT OF WATER RESOURCES 2010 <sup>30</sup></p>	<p>Establishes objectives, strategies, targets and indicators, between which found to develop the comprehensive management of the risks associated with the supply and availability of water through mitigation measures and adaptation to reduce the risks associated to hydric offer phenomena resulting from climate variability and climate change. Through this policy to search ensure the sustainability of the resource by:</p> <ul style="list-style-type: none"> <li>Efficient and effective use, articulated the system and land use.</li> <li>Conservation of ecosystems that regulate the hydric offer.</li> </ul>
<p>CONPES 3700 - 2011 INSTITUTIONAL STRATEGY FOR THE ARTICULATION OF POLICIES AND ACTIONS ON CLIMATE CHANGE IN COLOMBIA<sup>31</sup></p>	<p>Institutional Strategy for the articulation of policies and actions on climate change in Colombia. The objective of Conpes is facilitate and encourage the formulation and implementation of policies, plans, programs, incentives, projects and methodologies in matter climate change, achieving inclusion as determinants for the design and planning of development projects climatic variables, through configuration to scheme of inter-sectorial articulation. This scheme should permeate the current model of social and economic development transversely at all levels and in all institutions. Additionally, it should permeate the highest levels of decision-making in each of the sectors and communities.</p>

TABLE 1.7: PLANS, POLICIES AND STRATEGIES IN MANAGEMENT OF WATER RESOURCES

<sup>29</sup> Source : [https://www.minagricultura.gov.co/Normatividad/Conpes/conpes\\_113\\_08.pdf](https://www.minagricultura.gov.co/Normatividad/Conpes/conpes_113_08.pdf)

<sup>30</sup> Source : [http://www.minambiente.gov.co/documentos/5774\\_240610\\_libro\\_pol\\_nal\\_rec\\_hidrico.pdf](http://www.minambiente.gov.co/documentos/5774_240610_libro_pol_nal_rec_hidrico.pdf)

<sup>31</sup> Source : <https://www.dnp.gov.co/LinkClick.aspx?fileticket=2yrDLdRTUKY%3D&tabid=1260>

## 2. ASSESSMENT OF STATUS AND PROBLEMS OF INFORMATION SUPPLY IN THE AGRICULTURAL SECTOR

For food (and water) security programs, actual and accurate (spatial) information is crucial for land and crop production systems to provide quick indicators on the context (e.g. water availability), status (e.g. biomass, crop type, acreage, etc.) and trends (within and in between seasons, years) of local farming practices/performance. In this section, the main challenges in information supply in Colombia are summarized as well as the institutional capacity to support viable information services.

Spatial information described the physical location of objects and the metric relationships between objects, therefore spatial analysis with GIS- geographical information systems capture, store, manipulate, analyze, manage and enable for collaborative decision making. GIS technology and spatial information systems could contribute to the development of multi-sectoral integrated land-use planning for sustainable and equitable natural resource (with reference to land, agriculture, fisheries and forestry).<sup>32</sup> Spatial information, include global positioning system (GPS), GIS information, variable rate technology –VRT- (e.g. used for applying soil amendments), and remote sensing –RS- used for detection of energy reflected or emitted (Lowenberg-DeBoer, 1998).

The use of information in production agriculture may either increase or decrease the expected value of relevant economic factors such as production, input usage, costs and profitability or welfare measures (Mjelde and Hill; Mjelde, Penson, and Nixon; Hill et al. 1999a)

Therefore, precision farming is a farming management concept generated by information systems based on observing, measuring and responding to inter and Intra field variability crops. Crop variability have spatial and temporal component, which makes statistical/ computational treatments involved. However, the difficulties to define those support systems are that every single crop has their owns variable prioritization as the practices applies, but the goal is to optimize returns on inputs while preserving resources (see, for example, McBratney et al. (2005),[2] and Whelan et al. (2003)[3]).

Precision agriculture also provides farmers with the following information: Build records of the farms, improve decision making having more information, foster greater traceability, enhance marketing of farm products, improve lease arrangements and relationship with landlords and enhance the inherent quality of the farm products.

Those information systems and support decision systems, are very useful for Agricultural sector, however the value of the data, depends on the procedure to capture it, quality control of data, protocols WMO - World Meteorological Organization and so on, to be able of compatible systems and reliable accurate information sharing across platforms.

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<sup>32</sup> Source: <http://www.fao.org/forestry/13148-0d55a7790acfdbcce50fc3d684ae3063c.pdf>

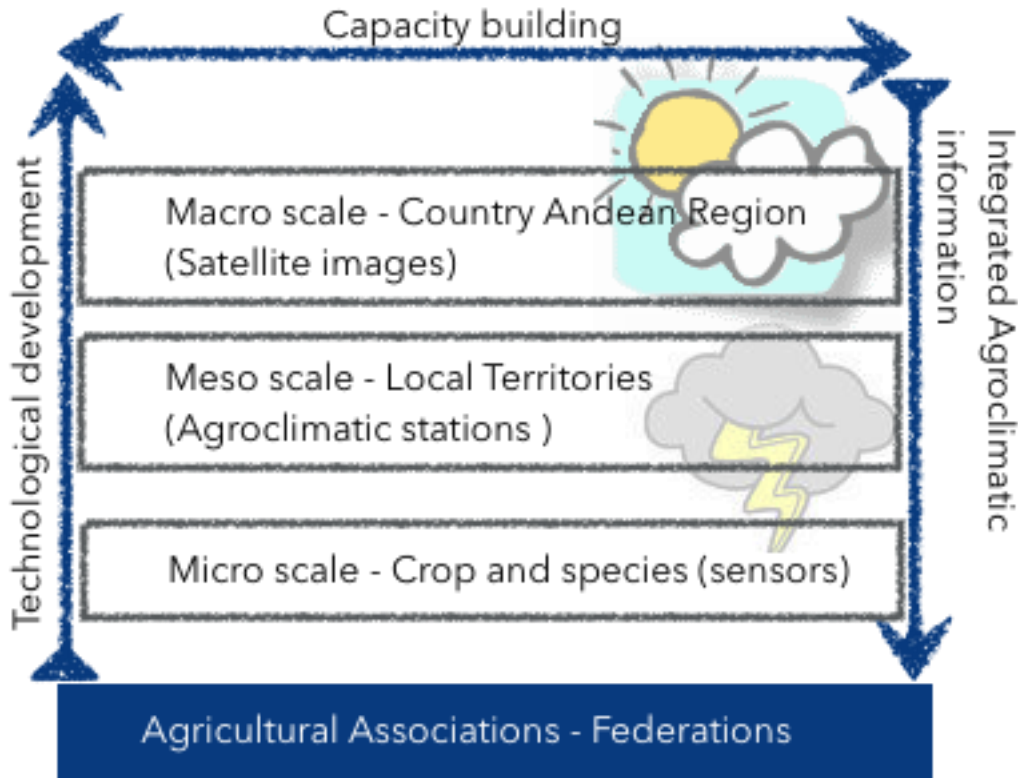


FIGURE 1.6: CAPACITY BUILDING

## 2.1 MAIN CHALLENGES IN INFORMATION SUPPLY ENCOUNTERED IN AGRICULTURAL ACTIVITIES

For Colombia the main challenge for information system in agricultural activities are addressed from the stakeholders:

### Rural Community

The low educational level, the little or no transfer of knowledge and difficult access to new technologies makes the producers or peasants don't see the use or utility of the information. A big challenge to deal with is the lack of local contents, technological appropriation, applications for the small holders, articulated networks and farming communities. For example<sup>33</sup>, traceability presents possibilities to combine the potential of young people to use information and communication technologies and at the same time, benefit the social and economic development of rural areas.

### ICT- Information system availability & capacity

The low purchasing power of the citizen, internet connection it's still relatively high for the average income , so there's limited access, as well in infrastructure because only 18% of 1102 municipals has fiber optic. Use and adoption of ICT is necessary but not sufficient to improve the productivity and competitiveness of companies in agricultural sector<sup>34</sup>. It's necessary to invest in capacity building to update technical assistants and actors responsible

<sup>33</sup> Source: [www.e-agriculture.org/es/e-agricultura](http://www.e-agriculture.org/es/e-agricultura)

<sup>34</sup> En Tecnologías de la información y la comunicación (TICs), productividad y competitividad, por Ricardo Monge González, Cindy Alfaro Azofeifa, y José I. Alfaro Chamberlain. Source: [http://www.crdi.ca/en/ev-89287-201-1-DO\\_TOPIC.html](http://www.crdi.ca/en/ev-89287-201-1-DO_TOPIC.html)

for technology transfer in the use and management of ICT. Moreover, GIS and data base information systems in Colombia are not made for common use, so it's necessary a development, to share, improve the quality of information, and its analysis to make it available in an easy way to everyone. The challenge is to add value to the existing systems or data platforms, not only in the information collection, but compatible and sharing with other systems.

### **Government**

Greater investment is needed in equipment and technologies that enable the widespread use of ICT in the regions and farming communities. Investments in rural information systems can improve levels of knowledge and management capacity of farmers. In many developing countries, while Internet-based technologies are spreading rapidly, there is still a serious lack of basic telecommunications infrastructure in Colombia<sup>35</sup>.

### **Sectors**

Extension services for some sector, is the direct connection with small holders, so they need to have access and knowledge of the useful information regarding climate, resource availability and productivity of crops to broadcast and collect also information in situ. Strategic sectors have to share and learn from the past that the information systems are useful for all growers, hence alliances and cooperation between each others entail a better platform systems and broadcast along Colombia.

#### 2.2 INSTITUTIONAL CAPACITY TO SUPPORT VIABLE INFORMATION SERVICES

- a) ICT for improving land management (eg, soil) and for the planning of land use, especially when users have different perspectives and preferences on a specific territory (different crops).
- b) Using ICT to transform agricultural practices for more environmentally sustainable development.
- c) The mobile phone services have great potential for conveying information about sustainable agriculture producers and other actors in the agricultural value chain. The ability to raise large amounts of sensor data using mobile technology (eg, remote sensing of soil), has the potential to provide information leading to favorable climate solutions. Mobile technology offers the opportunity for producers to become data collectors locally, making it possible to obtain real-time data and identify trends to alert producers. The increasing penetration of mobile phones (more than 50 millions mobile lines in Colombia<sup>36</sup>) in rural areas, allowed more producers connected and able to receive early alerts in real time or near real time.

From an earlier NWP mission in 2012, one of the main issues is that spatial information is often not open and free available and not centrally maintained and managed. An open data strategy for future agricultural support is therefore a main challenge to tackle. Additionally, in the earlier mentioned peace process with the FARC and Colombian government (spatial) objective information plays a crucial role in the access and use of the land when it becomes available after the conflict for remigration of farmers. Capacity Building and structural reform of the Cadastre in Colombia is needed.

### **Ministry of agriculture and rural development: Cadastral Information**

The ministry of Agriculture and rural development -MADR- as the main institution for agricultural sector, divides internally in productive chains, agricultural and forestry chain and livestock chains, fisheries and aquaculture. Regarding the need of information for food production, and the sector in general, the document focus and describes the existing information systems starting in macro level with the government institutions, such as the ministry to specific systems for crops or producers.

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<sup>35</sup> Source: ARIAS, Jhon. Ing. Agr. MSc. Consultor Epsagro Gasa. Mayo de 2014.

<sup>36</sup> Source: <http://www.sic.gov.co/informe-telefonía-movil-primer-trimestre-de-2012>

In the earlier mentioned peace process with the FARC and Colombian government (spatial) objective information plays a crucial role in the access and use of the land when it becomes available after the conflict for remigration of farmers. Plans of technical assistance need to be developed for property of land, spatial, protection of National reserves. (Cadastral issues, ownership)

#### **Agro water climate challenge**

The Ministry of agriculture and rural development is recently developing an app (agroclima<sup>37</sup>) for mobile and easy to use ICT platforms supplying actual information to the agricultural sector for better decision making. Translation of climate data (trends analysis), per province, per departmental level to agro-climate reports of climate-agro conditions on both scales should lead to further support in warning of drought, flooding, water availability assessment, etc. Even this app can work on municipality level for groups of crops and for advising the needs for water irrigation for agriculture. It also helps for example in planning the start of the growing season (timing of sowing). The challenge is to provide the actual data for this platform in a operational and continuous mode. The Colombian institute IDEAM validates the data.

#### **Water resources distribution for agriculture**

It is a general problem that water distribution is a big challenge in the Colombian agricultural sector. For example the sugarcane sector is depending on continuous availability of water and is very sensitive to temporary lack of water. The challenge is to find a way to pinpoint priority areas where can be anticipated on upcoming shortage of water during the season to take timely measures on irrigation or water storage/management.

One Dutch project (eLeaf) is being developed with CORPOICA UNAL (agric monitoring), von Humboldt Institute (Landscape Institute, ecology). The idea is to work on the impacts on water resources in intensive production systems that are being developed in the Altillanura.

Another challenge is the pollution of ground water problem (due to mining waste water) for the agricultural sector. Besides that it affects also the drinking water supply, nature and environment (socio economic impacts).

#### **Water accounting problems**

Colombia is a netto export country of agricultural products. This puts enormous pressure on the water availability in groundwater systems. For example the export of inputs for European countries for animal fodder (soya, maize, etc.) is exhausting Colombian soil-water systems. It is therefore important to monitor the water footprint per crop/product in agriculture in Colombia (per region)<sup>38</sup>. Challenge is to map and monitor and with that to control water demands per region (stress), and manage the distribution of water resources. The Food industry sector is also an intensive user of the Colombian water resources. Another example are the coffee plantations in terms of water use efficiency.

Information for Land use evaluation planning for most optimal use and organization of land use (planning of water use) is another essential issue to address.

#### **Water risk reduction**

Since the Flooding of 2011 (cooperation bilateral NL and Colombia) needs are addressed in the context of Delta technology, water (infra) engineering, transport inland water (shipping, routing, etc.), etc. leading to opportunities in the water technology sector. The challenge for the water problems in the agri-sector is to protect sensitive regions

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<sup>37</sup> Source: <https://play.google.com/store/apps/details?id=co.gov.agronet.agroclima>

<sup>38</sup> Source: Wateraccounting.org of A. Hoekstra University of Technology Twente

to water disasters (drought and floods) in the rural area affecting the agricultural systems with smart information (preparedness) strategies.

It has been found that there are in Colombia four main barriers that constrain the massive use of the information or ICT in the agricultural sectors:

- The producers, peasants and indigenous don't see the use or utility of the information. Low educational level of rural communities, little or no transfer of knowledge and difficult access to new technologies. It must be remembered that the knowledge-based economy is a totally different economy of the twentieth century economy. In addition, as noted Atkinson (2001), in the modern world, the most prosperous economies are based on the skills of its citizens, businesses, organizations, government, academia and the private sector to generate, store, retrieve, process and transmit information, functions that are applicable to all activities. Distrust of farmers and poor access to new technologies and / or tools. Several recent studies indicate that the ability to buy (sell) and payable (receivable) via the Internet (e-commerce) as well as the integration of supply chains through computer applications and the Internet (e-business) since the early 1990s, are clear opportunities for SMEs to overcome some of their technological deficiencies, environment, organizational and administrative (Al-Qirim, 2004). However, we see very little adoption of computer-based and Internet applications (adopting ICTs) by SMEs, both in poor countries and the rich (Lefebvre and Lefebvre, 1996). The lack of local contents and applications for the small Enterprise as well as of the technological appropriation. Lack of articulated networks farming communities, lack of benefits derived from the implementation of ICT in their daily requirements and traceability of agricultural products work. For example<sup>39</sup>, Traceability presents possibilities to combine the potential of youth to use information and communication technologies and at the same time, benefit the social and economic development of rural areas.
- Low purchasing power of the citizen, internet connection it's still relatively high for the average income, so there's limited access. Low levels of adoption and implementation of ICT. It should be remembered that access, use and adoption of ICTs is a necessary but not sufficient to improve the productivity and competitiveness of companies in this sector but condition<sup>40</sup>.
- High costs for infrastructure to spread, now a days 18% of the municipalities from the 1.102 are connected through optic fiber. The geographical conditions and scatter limited the telecom network. upgrade to the technical assistants and actors responsible for technology transfer in the use and management of ICT. The results and information generated by the national science and technology are not being transferred to farmers and agricultural technical assistance is highly deficient. ICT would be very useful to solve this problem.
- Economic Resources, Colombia has limited resources for infrastructure. There's some programs from Ministry of Information Technology and Communications -MINTIC- such as Digital plan to keep investing in connectivity<sup>41</sup>. Greater investment is needed in equipment and technologies that enable the widespread use of ICT in the regions and farming communities, low connectivity and poor training of the actors engaged in rural development. Information and communication are also essential for sustainable agricultural and rural development. Investments in rural information systems can improve levels of knowledge and management capacity of farmers. To raise awareness, information, sharing experiences, changing attitudes and strengthen communication skills and learning processes are required. In many developing countries,

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<sup>39</sup> Source: [www.e-agriculture.org/es/e-agricultura](http://www.e-agriculture.org/es/e-agricultura)

<sup>40</sup> En Tecnologías de la información y la comunicación (TICs), productividad y competitividad, por Ricardo Monge González, Cindy Alfaro Azofeifa, y José I. Alfaro Chamberlain. Source: [http://www.crdi.ca/en/ev-89287-201-1-DO\\_TOPIC.html](http://www.crdi.ca/en/ev-89287-201-1-DO_TOPIC.html)

<sup>41</sup> Source : FUENTE – Juan Carlos Mejia

while Internet-based technologies are spreading rapidly, there is still a serious lack of basic telecommunications infrastructure. In fact, the disparity in access to information between rich and poor is very large.

Moreover, there some other constrains such as shortage of virtual communities, monitoring, early warning systems, tracking, remote diagnostics, rural finance, market information, ecommerce, precision agriculture, agricultural management systems and georeferencing<sup>42</sup>.

As resource constraint it's important have into account needs of humanity<sup>43</sup>, such as the rational use of water, where the implementation of ICT could facilitate knowledge management, research, research and technology transfer. The water supply to millions of people is being increasingly threatened, so the intelligent water management will be a key policy for the twenty-first century. Issues such as economic growth, climatic conditions and population growth affect the availability of water resources. The situation is getting worse because of certain effects of climate, such as prolonged droughts and extreme weather events change.

In terms of education, to promote information system in agricultura communitas and farmers, its necessary to implement aggressive outreach and study of the Law 1341/089 (ICT Act), regulation and public policy challenges regarding the information technology and communications, because ignorance is widespread, especially at rural.

#### 2.2.1 GENERAL INFORMATION SUPPLIERS ACTIVE IN AGRICULTURE DOMAIN

The Ministerio de Agricultura y Desarrollo Rural -MADR- as the main institution for agricultural sector, divides internally in productive chains, agricultural and forestry chain and livestock chains, fisheries and aquaculture. Regarding the need of information for food production, and the sector in general, the document focus and describes the existing information systems starting in macro level with the government institutions, such as the ministry to specific systems for crops or producers.

#### **IDEAM Institute of Hydrology, Meteorology and Environmental Studies**

Offers a wide range of products updated and published on its website, which are available to users and are relevant for the agricultural sector. It's has meteorological network:

- Rainfall Measuring Station
- Home Weather Station
- Ordinary Weather Station
- Main Synoptic Station
- Supplemental Synoptic Station
- Radio-sonde Station
- Special Weather Station
- Agro- meteorological Stations are based in 3 department of Colombia (Antioquia, Valle del Cauca & Boyacá).
- Generated Newsletters: Weekly agro-meteorological monitoring and forecasting, monthly climatological, monthly technical report synoptic situation, climate prediction and alerts.
- IDEAM also produce decadal maps of water availability means, tracking weekly newsletter and forecast, monitoring of agro-meteorological conditions.

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<sup>42</sup> Source : FUENTE - Juan Carlos Mejia

[http://www.ais.unwater.org/ais/pluginfile.php/356/mod\\_page/content/119/Colombia\\_Informe%20Nacional.pdf](http://www.ais.unwater.org/ais/pluginfile.php/356/mod_page/content/119/Colombia_Informe%20Nacional.pdf)

<sup>43</sup> De las telecomunicaciones a las TIC: Ley TIC de Colombia: [www.eclac.cl/publicaciones/xml/1/43371/LC-BOG-L.22.pdf](http://www.eclac.cl/publicaciones/xml/1/43371/LC-BOG-L.22.pdf)



- The system is by HYDRAS software, under protocol requirements of the OWM -World Meteorological Organization.
- CAR - Regional Corporations for sustainable development are 26 in the country responsible for managing within its jurisdiction the environment, renewable and non-renewable natural resources and sustainable development in specific areas. These corporations have 365 meteorological stations; many of the information are taken from IDEAM because the quality control of hydro meteorological data in the CAR's is not very clear and there are serious doubts about it.

Generated Newsletters: Weekly agro-meteorological monitoring and forecasting, monthly climatologically, monthly technical report synoptic situation, climate prediction and alerts. IDEAM also produce decadal maps of water availability means, tracking weekly newsletter and forecast, monitoring of agro-meteorological conditions. IDEAM used HYDRAS software, under protocol requirements of the OWM -World Meteorological Organization.

### **MADR & FAO**

Agronet<sup>44</sup> is a platform developed by the MADR and FAO; its main objective is to meet the demand for statistical and analytical information of the agricultural sector, linking various databases (climate, surveys) needed to facilitate decision-making at the different industry players. The purpose of this tool is to:

- Integrate various agricultural information systems;
- Facilitate the provision of information in a single access point: web;
- Coordinate institutional efforts to facilitate the provision of information;
- Responding to the information needs of users of the sector;
- Facilitate decision making to improve productivity and food security in Colombia.

### **AGRONET/AgroMVA**

Agronet is composed by different subsystems such as:

- Sinigan: National system to identified and informed about cattle;
- Agroclima: necessary information to keep up on what is happening in relation to climate and environment information in Colombia AgroMVA;
- Agronegocios: to consult offers and demands of agriculture, livestock and agribusiness. To promote and support commercial relationships;
- Agromapas: Google platform maps with additional filters for the agriculture and livestock sector (area, location of crops, performance, land us);
- SIOC: Information system of performance and management of agricultural chain organizations.

### **MADR – Colciencias/RICCLISA**

It is a technological development based on ICT and free software to support the management of agricultural production processes from monitoring and analysis of agroclimatic variables, delivery services, climate monitoring and near real-time to generate early warnings (reports to mobile devices, phone call, e-mail, sms, etc.).

It's designed to integrate satellite data Goes -Geostationary Operational Environmental Satellite (On-line) in his three seasons infrared, visible and water vapor spectrum. Has an alert system that is programmed to extreme temperature events or precipitation. It will be integrated into the databases AGRONET (MADR) so will contribute to

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<sup>44</sup> Source: <http://www.agronet.gov.co/agronetweb1/QuienesSomos/AntecedentesyObjetivos.aspx>.. a continuación se describe la plataforma tecnológica de Agronet

the consolidation of a large bank of agro climatic data (climate, production, land, technology, socio-economics) of the national agricultural sector.

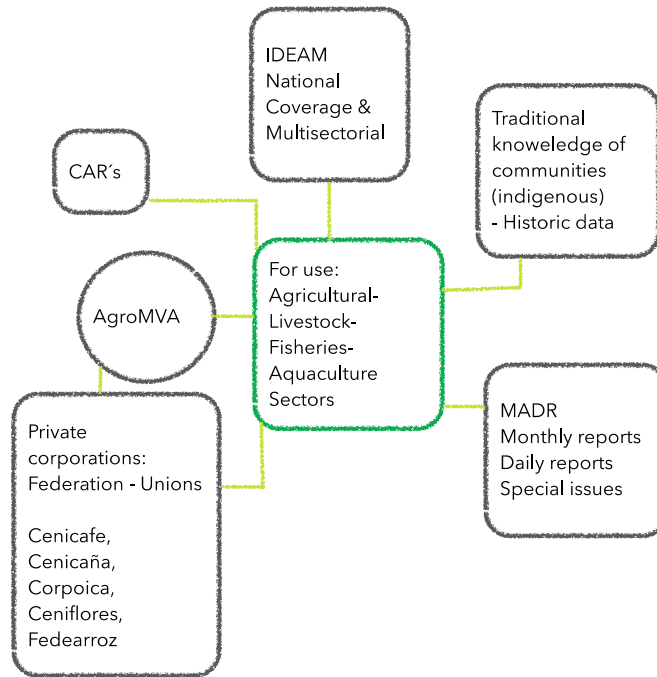


FIGURE 1.7: OVERVIEW AGRO CLIMATIC DATA

## Other database systems from Colombia government institutions

The table below represents a list of other database systems.

Institution - System	Objective – Goal
DANE - SISPA	Wholesale prices of food products Inputs and factors associated with agricultural production and the level of food supply in cities.
IGAC – Instituto Geográfico Agustín Codazzi – ICDE Colombian Spatial Data Infrastructure SIGOT Geographic Information System for the national land use planning	ICDE It's part of OGC (Open Geospatial Consortium) that have standards that helps to remove technical obstacles to institutional information sharing.  SIGOT contributed decision-making, supporting actors - authorities and bodies - in the planning system at national, regional and local levels, with a technological tool.
MADS- INVEEMAR- IDEAM- IIAP – SINCHI- ANLA- IAvH SIAC Environmental Information System of Colombia	SIAC website for natural resource: SIRH- provides information-integrated management of water resources by recording, managing and querying data, databases, statistics, systems, models, documentary and bibliographic information, regulations and protocols. SISAIRE- is the main source of information for the design, evaluation and adjustment of national and regional policies and strategies for prevention and control of air quality.
CORPOICA SIEMBRA	Virtual platform that promotes knowledge by design and produce indicators in terms of science, technology and innovation in agricultural sector.
CCI – International Colombian Corporation SIESA	Integration of information from national and international institutions on price statistics, marketing, market intelligence, technology, technical standards and phytosanitary for the agricultural sector, especially the fruit and vegetable subsector. It also have physical indicators of agricultural production, area, yield, and its in construction for organic products.
Amazon institute for scientific research – SINCHI DataBase	Information system about biodiversity, production systems and population settlement in the amazon region
SAC – Colombian Agriculture Society Economic Database	Statistics and compilation of economic studies for the agricultural sector
BNA DataBase	Monthly and weekly information about prices for wholesalers and transactions quantities of agroindustrial products and agricultural & livestock products.

TABLE 1.8: DATABASE SYSTEMS FROM COLOMBIA GOVERNMENT INSTITUTIONS

### International organizations

#### FAO - AquaCrop

Using the Model "AquaCrop" to estimate crop yields in Colombia, in the Framework of the Study of Economic Impacts of Climate (EIECC) Rates. Contribute to the definition of public policies that include strategies for adaptation and mitigation of climate change, to increase the resilience of communities and their livelihoods to help in the fight against poverty and the achievement of the MDGs. AquaCrop is a descriptive model that simulates the potential harvestable biomass and crop yield in response to water availability. Simulates the performance according to water transpired by the crop, as the volume of water available in the soil, calculated from data of rain and / or irrigation in the soil. It also determines optimal planting times according to conditions of climate, soil, crop and agronomic management.

## IICA

Provides technical cooperation, innovation and expertise to the competitive and sustainable development of agriculture and improves the lives of rural people in the Americas (34 members). It has two information systems:

- CAESPA strategic analysis center for agriculture
- SIDALAC Alliance of agricultural information services: Facilitates access to information produced in the Americas that is duly organized in agricultural institutions, libraries and other information centers related. This service center has specialized information resources like documents concerning issues such as crops or water and food security. Colombia is bound to this information center by MARD.

## Specific crops or Federations

Historical data and actual networks of some association are fix up access, with some constrains in the type and data frequency. In the following table are summarized the main information systems of the different crops in Colombia.

Organization/ Federation - System	Objective- Goal
CIAT- <i>International Center for Tropical Agriculture Member of CGIAR</i> <b>Terra- I “An eye of habitat change”</b>	Detects land cover changes resulting from human activities.
Fedegan – <i>Cattle Federation</i> <b>SIT – Technical Information System</b>	To program cycles of vaccination, registration and consolidation of the national inventory of land and cattle herd.
Fedearroz – <i>Rice crop federation</i> <b>Weather stations</b>	25 automatic weather stations to meet daily fluctuations in critical variables for cultivation, as solar radiation, extreme temperatures, wind speed and precipitation.
Fenalce – <i>Federation of grain &amp; cereals- Statistics</i>	Economic information, prices, yields, production.
Fedepapa- <i>Potato Federation</i> <b>VIGIPAPA</b>	Monitoring and surveillance of plant potato growing areas of the country. Sisfito supported.
Cenicaña - <i>Research Center of Sugarcane in Colombia RMA- Automated Weather Network</i>	34 Stations, to optimize technological & production actions for the sector.
FNC – <i>National Coffee Federation</i> <b>SICA Coffee Information System</b>	Country-geo-referenced national coverage of coffee farms. Implementing the ArcGIS platform in the SICA system @ ESRI (mapping software) Web user. In this case the platform is the SICA that has two databases of information for decision as follows: -Database that is geo-referenced spatial location and altitude. -Alphanumeric data-base coffee growers and coffee farms, including its production characteristics.
Cenicafe – <i>Science, technology and innovation for Colombian coffee production</i> <b>AgroClima</b>	Coffee alerts, weather alerts, agro-meteorological reports - 336 stations, with cooperation of MADR. a) Variable temperature, relative humidity, rain and sunshine. b) In the helio pluviográficas rain and sunshine stations is measured. c) In the heliographic stations recorded the sunshine. d) The pluviographic stations are equipped with recorders that provide insight rain amount and intensity of precipitation. e) Stations have pluviometers in rainfall stations to measure the amount of rainfall. <b>Siascafe</b> Online System for Interpretation of Soil Analysis coffee
Cenipalma - <i>Corporation Research Centre for Oil Palm</i> <b>CeniSpace</b> <b>SMACPALMA</b>	Cenispace- Appreciate the establishment of cadastral lots of oil palm and trapping network nationwide for Rynchophorus palmarum Smacpalma- Weather Stations installed in various plantations provides access to oil palm sector of information services
Ceniflores - <i>Center for Technological Innovation Flower Sector</i> <b>Canalclima</b> – private company provides the information, there's a fee for access	Meteorological data from 18 stations in Bogota and Antioquia. Data are used to determine the spatial distribution of precipitation, solar radiation, temperature, wind speed and humidity in those areas.

TABLE 1.9: MAIN INFORMATION SYSTEMS OF THE DIFFERENT CROPS

2.2.2 SPECIFIC AGRI-SECTOR INFORMATION SUPPLY AND CURRENT MECHANISMS

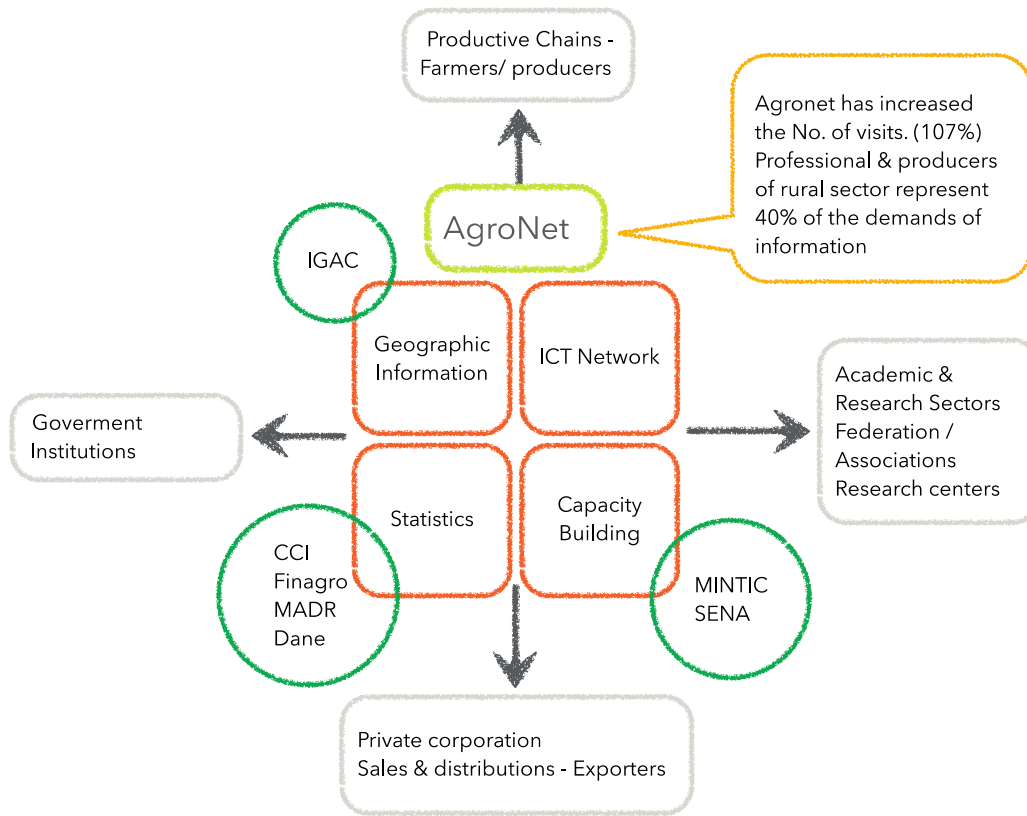


FIGURE 1.8: AGRI-SECTOR INFORMATION

In Colombia, there are significant advances in precision agriculture in commercial banana crops (AUGURA), palm oil (CENIPALMA), crops such as corn and soybeans (FAZENDA - ALIAR), corn and pea fruit (CIAT, Biotec Corporation) and sugarcane (Cenicaña). The latter has led a technological restructuring process aimed at implementing agronomic practices required by sugar cane according to the spatial and temporal conditions of the site where it is grown. The work has required successive approximations of agro ecological zoning in Valle del Cauca and now have an interactive information system that provides various analysis tools and query geographic databases, weather and commercial production, with support for decision making for the site- specific crop management.

**Intelligent management of water – Project developed in cooperation of Netherlands Government**

The agricultural sector depends and relies on spatial information, not just for climate information, but also for decision-making. Therefore as was described before the inventory of information systems that supplies the agricultural sector, are not aligned to consolidate the information and cooperate to different crops and needs of each association.

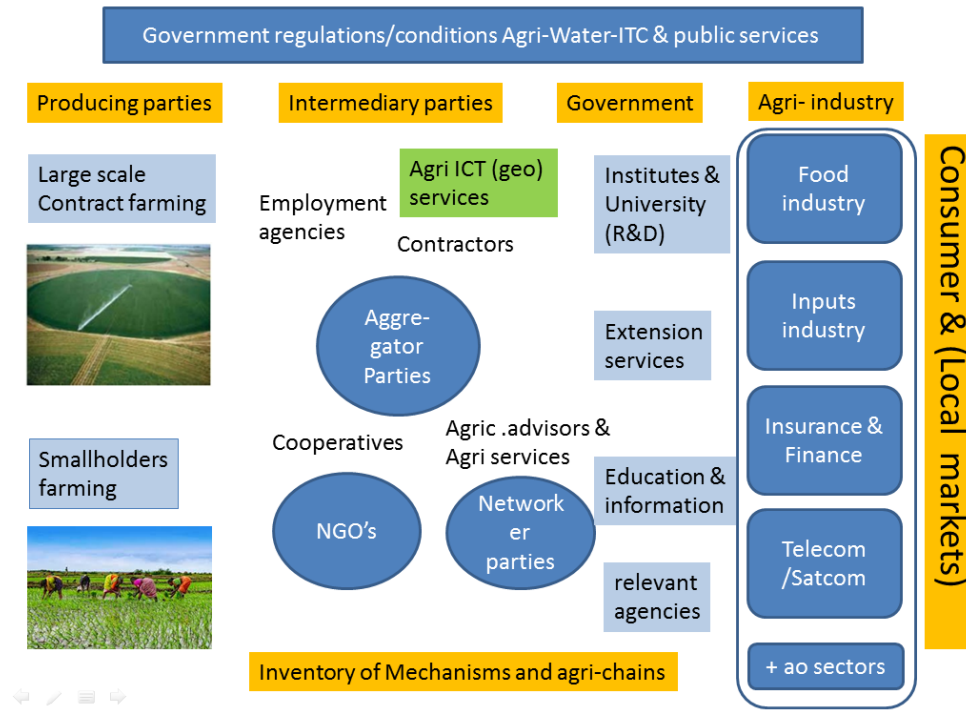


FIGURE 1.9: GOVERNMENT REGULATIONS AGRI-WATER-ICT & PUBLIC SERVICES

During the NWP mission in Colombia, the above scheme will help in identifying the role of information in a traditional agri-partner chain (from production to consumption/market), the typical stakeholders in Colombia and how the potential role of spatial information (with special attention to remote sensing) could be in future G4AW cooperation programmes.

### 2.2.3 OTHER SECTORS (AND ROLE OF INFORMATION) IMPORTANT FOR THE AGRICULTURAL SECTOR

MINTIC is generating and Alliance with the MADR to promote the use of rural kiosk, that are installed in 1144 urban centers with more than 100 habitants. Those kiosks have internet connection and the purpose is to create a local digital community that will have access to different platforms and internet websites, so will be like a “crowd sourcing” for data uses. MinTic’s goal is to have more than 7500 kiosk around Colombia. A company like C3 – Call centers gives the services and have infrastructure for a low cost service for massive text messaging to any cell phone or mobile dispositive.

*Water Government Centre* (Daphne Willems) showed the results of the analysis carried out in Colombia (January-April 2013) to identify the bottlenecks of the country in water governance. The base line of the study was the results of the Water Governance Mission (Misión Gobernanza del Agua, MGA) from 2011 to 2012, which consisted of a series of workshops to map the water governance situation in the country. Some of the conclusions of the study were the evident lack of coordination between the institutions responsible of the water management and their isolation in the search for solutions. Besides this, the interpretation of existing polices (from a national to a regional level) to tackle the encountered problems represent one of the main challenges. The WGC presented specific solutions and next steps to strength the water governance in the country and a follow up is expected with the involved parties. Participants of the meeting showed their interest on taking part in the coming developments around this topic and to look at possible opportunities.

### 3 NEEDS ASSESSMENT OF IMPROVED ICT & INFORMATION SUPPLY IN THE AGRI SECTOR

In this section, an inventory of specific needs and problems in the information supply (and demand) in the Colombia agri sector is provided. The most important local stakeholders represented in the identified problem domains are selected (short list). Furthermore, additional stakeholders in related domains need to be selected (e.g. water domain, nature, industry, etc.).

#### 3.1 NEEDS ASSESSMENT WITH A FOCUS ON POTENTIAL USE OF SPATIALLY BASED INFORMATION SERVICES

ICT investment will always be subject to the benefits generated in terms of increased productivity and cost savings, which in turn depend on the use that producers can make those technologies in agricultural production. As the scale of use conditions, while the development of content, tools and specific services, it is important to have public policies to overcome the initial barriers and thus enhance the dynamic between the actors<sup>45</sup>.

The demands of weather information from the national agricultural sector cannot be fully covered by IDEAM, since their functions are basic information on national and sectoral level; it is therefore necessary that the sector generates their own networks and platforms collection and supply both climatologically information and otherwise (monitoring soil conditions, production, technology, socio economic, etc..)<sup>46</sup>.

For the agricultural sector in terms of TIC's the principal needs are:<sup>47</sup>

- Modeling of hydrodynamics on rice , coffee , palm oil , bananas , cacao, citrus
- Spatial analysis tools
- Biodiversity characterization models
- Zoning patterns of crops and natural areas protection
- Models of water footprint and carbon footprint in the agricultural sector.
- High resolution images for coverage analysis , age of crops, morphological analysis and diseases and crop heights
- High resolution satellite images for high-accuracy mapping scale of 1:1000 , 1:5000 , 1:10,000
- Digital elevation models to 10 meters high
- We need capacity data transmission in real time for immediate response system for farmers and scientists
- Equipment to measure in real time at low altitude (Drones ) for specific crops
- Servers reduction information faster
- Trained personnel required
- Specialized software to crop for geomorphologic data , land use , digital terrain models .
- Spectral images ( passive sensors ) . Cenipalma have Cenicaña and advances.
- Equipment and field spectral multispectral sensors.
- Lasers for measuring morphology and structure of plants.

<sup>45</sup> Source : [www.eclac.cl/ddpe/noticias/noticias/8/45738/RHopkins.pdf](http://www.eclac.cl/ddpe/noticias/noticias/8/45738/RHopkins.pdf) Tendencias de uso y potencial de las TIC en la agricultura...

<sup>46</sup> Source: Informe Consultoría- Gestión Información Agroclimática en Colombia . Julio 2012- Programa de Adaptación al cambio climático en la Región Andina.

<sup>47</sup> Source: RIAÑO, Néstor. PhD. Fisiólogo. Investigador III. Cenicafé. Mayo de 2014

In general terms, Colombia needs to plan and determine land uses by zones, productive products, and approach precision agriculture for many products, especially for food security. Also, to promote agro industrial crops in a macro level like biofuels.

Smallholders needs to be prepare for alert system and climate prediction to be able to increase productivity, minimize risks, control pest and phitosanitary problems with satellite or radar information systems.

Those systems will allowed the possibility to generate financial and insurance products for farmers according to climate conditions, variability for regions, and crops.

Water as the main resource in all farm activities, have to be monitored and followed up related by the hydric footprint.

### 3.2 PUBLIC AND PRIVATE PROBLEM STAKEHOLDERS AND INTERNATIONAL ORGANIZATIONS IN THE DOMAIN OF G4AW

The tables below representing the most important stakeholders.

<u>Ministries</u>	<u>Government Entities</u>
MADR	ICA
MADS	CORPOICA
Departamento de Planeación Nacional	INCODER
Departamento para Prosperidad Social	ICBF
Ministerio de Educación	IAVH
Ministerio de Salud y Protección social	COLCIENCIAS
	CCI (Private & Public)

<u>Universities</u>	<u>Research Center</u>
Universidad Nacional de Colombia	CIAT
Universidad Javeriana	CENICAFE
Universidad de Caldas	CENICAÑA
EAFIT	CENIPALMA
Universidad del Valle	CENIACUA
Universidad de los Andes	AUGURA
	CONIF
	CENIFLORES

TABLE 1.10: MOST IMPORTAT STAKEHOLDERS <sup>48</sup>

Fedesoft , the professional body of the IT sector to unionizes Industry Software and Related Information Technologies , in order to represent their interests to public and private entities, national and international level . American Software , ASD Group , MVM Software Engineering, Compufácil , Asesoftware , Intergroup , PersonalSoft, Consitoría and Computer Services - CSI Services Soil and Water Engineering SA , among others.

UNE - EPM Telecomunicaciones , Bogotá Telecommunications Enterprise – ETB

<u>International Organizations:</u>
FAO Colombia
UNODC Colombia
IFAD

<sup>48</sup> The full list is to be find in Annex 1





### 3.3 ONGOING G4AW RELEVANT ACTIVITIES AND/OR PROJECTS IN COLOMBIA

The mechanism of GEO-data for agriculture and water (G4AW) is a new program of the Ministry of Foreign Affairs of the Netherlands, established in the framework of strategic priorities for food security and water. The G4AW is focused on the improvement and augmentation of sustainable food production and more efficient use of water in agriculture. The Netherlands Space Office implements this program.

- Food security policies in the countries of the Andean Community of Nations. Regional Food Security Strategy for Countries of the Andean Community<sup>49</sup>.
- Projects of the Department for Social Prosperity - DPS, ReSA<sup>50</sup>
- A garden for all <sup>51</sup>- Antioquia
- Ministry of Agriculture and Rural Development - Water Projects, design, modification and construction of irrigation districts; "Sustainable water"; through INCODER and FINAGRO
- Projects Findeter <sup>52</sup> construction or improvement of urban and rural water supply<sup>53</sup>.

### 3.4 REFERENCES TO PUBLIC DOMAIN PUBLICATIONS

- Regional Food Security Strategy for Countries of the Andean Community<sup>54</sup>. Project of Departamento para la Prosperidad Social – DPS, ReSA<sup>55</sup>.
- Ministerio de Agricultura y Desarrollo Rural – Water projects, design, modification and construction of irrigation districts; "Sustainable water"; through INCODER and FINAGRO.

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<sup>49</sup> Source: [https://www.minagricultura.gov.co/Normatividad/.../conpes\\_113\\_08.pdf](https://www.minagricultura.gov.co/Normatividad/.../conpes_113_08.pdf) = Política de Seguridad Alimentaria - Ministerio de Agricultura ...

<sup>50</sup> Source: [www.parlamentoandino.org/csa/...de.../31-seguridad-alimentaria.html](http://www.parlamentoandino.org/csa/...de.../31-seguridad-alimentaria.html) Cumbre social andina – Seguridad Alimentaria

<sup>51</sup> Source: [https://coin.fao.org/coin-tatic/cms/.../cartilla\\_una\\_huerta\\_para\\_todos.pdf](https://coin.fao.org/coin-tatic/cms/.../cartilla_una_huerta_para_todos.pdf)

<sup>52</sup> Source : [www.findeter.gov.co/](http://www.findeter.gov.co/)

<sup>53</sup> Source: [www.latribuna.hn/.../los-distritos-de-riego-para-el-desarrollo-agricola-na.](http://www.latribuna.hn/.../los-distritos-de-riego-para-el-desarrollo-agricola-na.) = Los distritos de **RIEGO** para el desarrollo agrícola **NACIONAL**...

<sup>54</sup> Source: [https://www.minagricultura.gov.co/Normatividad/.../conpes\\_113\\_08.pdf](https://www.minagricultura.gov.co/Normatividad/.../conpes_113_08.pdf) = Política de Seguridad Alimentaria - Ministerio de Agricultura ...

<sup>55</sup> Source : [www.parlamentoandino.org/csa/...de.../31-seguridad-alimentaria.html](http://www.parlamentoandino.org/csa/...de.../31-seguridad-alimentaria.html) Cumbre social andina – Seguridad Alimentaria.

<sup>56</sup> Source : [https://coin.fao.org/coin-static/cms/.../cartilla\\_una\\_huerta\\_para\\_todos.pdf](https://coin.fao.org/coin-static/cms/.../cartilla_una_huerta_para_todos.pdf)

## 4 INVENTORY OF POTENTIAL (CHAIN) SOLUTIONS DIRECTIONS USING GEO-ICT IN LOCAL AGRICULTURE ISSUES

### 4.1 BASE SOLUTION DIRECTIONS IN COLOMBIA TAILORED TO LOCAL AGRICULTURAL PRACTICES

Specific (geo-) ICT developments to be implemented in the agricultural sector have potential to improve current information mechanisms:

- a) ICT for improving land management (e.g., soil) and for the planning of land use. Among the many ICT world, there are two key planning and land management tools: Geographic Information Systems (GIS) and Remote Sensing techniques "Remote Sensing". GIS offers the opportunity to gather multiple phases of information in a single environment, which can be particularly useful for reaching consensus in reference to planning land use, especially when users have different perspectives and preferences on a specific territory (different crops).
- b) Using ICT to transform agricultural practices for more environmentally sustainable practices.
- c) The mobile technology to bring information on climate-smart agriculture farmers. The mobile phone services have great potential for conveying information about sustainable agriculture producers and other actors in the agricultural value chain. The ability to raise large amounts of sensor data using mobile technology (e.g., remote sensing of soil), has the potential to provide information leading to favorable climate solutions. Mobile technology offers the opportunity for producers to become data collectors locally, making it possible to obtain real-time data and identify trends, to alert producers. For this to become a reality, it is necessary to identify appropriate measures to strengthen participation by producers' incentives. Incentives may include for example the use of free SMS messages, access to current and relevant information, status recognition and promotion, reimbursement of minutes on phones for making precise contributions, among others.
- d) ICTs as tools for adaptation and risk management. While generally there is enough information available for large producers in developed markets, with early warning systems to mitigate risks (e.g. on climate variables, pests and diseases, price volatility, etc.), the situation for small farmers fragmented and diverse environments is still a challenge. Information systems for risk mitigation often focuses on providing climate and pest information. This type of information could be effectively combined with market information, represents an opportunity for service providers. An example of a service that provides both types of information - for risk management and market prices - is Reuters Market Light (provides highly personalized agricultural information over mobile phones to the farming community).

The increasing penetration of mobile phones in rural areas allows more producers can receive early alerts in real time or near real time.

The Colombian government has done different projects to enforce data analysis and systems like:

1. ArcGIS Online Hydrodynamic Modeling Project The Mojana
2. ArcGIS from SICA platform of Coffee National Federation
3. CIIFEN/BID Analyze by surveys the needs of agro climate information in some sub sectors – flowers and rice-

## 4.2 DIFFERENTIATION OF SPATIAL SOLUTIONS TAILORED TO AGRICULTURAL PRACTICES/SECTOR IN COLOMBIA

Specific needs have been identified during the Colombian mission 2012 by CIWK. Solutions in general are not directly available, but actual information by remote sensing could help in monitoring and mapping various parameters relevant in below problems (see between brackets):

- ✓ Need for technology on water purification for agricultural use (water use efficiency/availability/evapotranspiration).
- ✓ Need for technology for soil purification and desalinization for agricultural use (crop performance monitoring).
- ✓ Need of technology and irrigation techniques and knowledge for water security in the agricultural sector. Banana, coffee, sugarcane, cacao etc. (in scarcity and flooding, flood extent and floodwater height, flood frequency).
- ✓ Implementation of technology for sustainable production especially in the agricultural focused on water and soil protection (crop performance, erosion).
- ✓ Need for irrigation technology and efficient water use (water use efficiency/availability/evapotranspiration).
- ✓ Information on the use of water and governance in the Magdalena watershed to support watershed management (water use efficiency/availability/evapotranspiration, water productivity, water accounting).

## 5 PARTNERSHIPS BETWEEN STAKEHOLDERS IN COLOMBIA AND DUTCH SECTOR

Important financial stakeholders with sustainable business interests in Colombia (Either local investors, insurance, banking, big agri-partners, etc):

Entity	Objective - Potential
Fundaescat – Ecopetrol	Focus interests are in forestry compensation and environmental services that will involve in different information systems. Also in terms of region of intervention are Catatumbo (Norte de Santander) and Boyacá that are productive with products such as palm oil, potato, onions, rubber, and many others.
EPM Foundation – EPM (household utility company)	Strategic investments are: Digital Inclusion and Appropriation of ICT Care, Use and Improvement of Natural Resources and Public Utilities
BID – FOMIN	Fomin investments are in tools for development, whose effectiveness is not only measured by financial results, but also by the characteristics of development.
GGGI Global Green Growth Institute	
The World Bank	The World Bank estimates that economic growth in the agricultural sector is twice as effective at reducing poverty as growth in other sectors of the economy.
Root Capital	A nonprofit social investment fund, grows rural prosperity in poor, environmentally vulnerable places in Africa and Latin America by lending capital, delivering financial training, and strengthening market connections for small and growing rural businesses.
Rabobank	A universal relationship bank in the Netherlands and elsewhere in the world. It wishes to continue to perform this role based on its cooperative orientation and principles. At the heart of society, nearby customers and focussed on sustainable development.

TABLE 1.11: OVERVIEW OF IMPORTANT FINANCIAL STAKEHOLDERS

### Colombian Water Platform (hosted by Netherlands Water Partnership)

One of the goals of the Colombian water platform is to organize the Dutch water sector around specific Product Market Combinations (PMC's) by forming clusters where their members will be actively working out the strategies needed (fact-finding missions, matchmaking at seminars, congresses) to approach concrete business opportunities in the Colombian water market. The selection of the specific PMC's is based on market potential and future developments in the Colombian water sector.

## 6 RECOMMENDATION FOR MATCHMAKING/MISSIONS

Economic growth in agricultural sector, as the World Bank mentioned, is twice as effective at reducing poverty as growth in other sectors of the economy. Moreover, as noted Atkinson (2001), in the modern world, the most prosperous economies are based on the skills of its citizens, businesses, organizations, government, academia and the private sector to generate, store, retrieve, process and transmit information, functions that are applicable to all activities.

In developed countries, the Information Technology and Communications (ICT) have transformed the production form and marketing in agriculture and living conditions of the rural population. One of the major changes that have led to the incorporation of ICT in agriculture in those countries relates to the better management of information, with impacts on production costs, transaction costs and innovation.

Therefore, Colombia has a challenge in ICT for agricultural sector, regarding adoption, data collection, compatibility, connectivity and access. However, the main challenge today is not so much to add information to the web and make it available but manageable by farmers<sup>57</sup>. For the ICT sector like others, have a big gap of education, comparing private to public or rural to urban sector, because in private sector are responsible for the product during the productive cycle so the probability to invest for information systems demonstrated in Cenicafe it's higher than another productive chain that is represented by the ministry; about the rural education, the access, quality and infrastructure is poorer than in urban areas, make it difficult to peasants and farmers. Therefore, public-private partnerships and international cooperation is an opportunity to generate education and capacities in rural areas for the utility of information.

Additionally, APP needs to concentrate how to bring the information downstream in the value chain. Therefore, G4AW seek for strategic alliances for smallholders in a significant number, because is where the food security are embedded as poverty alleviation. Moreover sectors such as coffee, sugar cane, rice and palm oil have information pretty much for all areas in Colombia, so share the information systems and determine applications about climate change should be accessible for all farmers.

Concentrated, accurate, current and with the greatest possible local interest information should be a goal for institutional portals and producers oriented information systems. Additionally, in terms of platforms its necessary to identify the more complete and potential of use to enforce and empower a consolidate information system, as well to articulate all the GIS information, climate alerts to them. For each sector or field of agriculture the information system should be tailored made by the requirements and variables affected.

Platforms potential should foster to a training process and capacity building in the system itself and stakeholders. Moreover, stakeholders should be responsible of the use and collection of the data, to manage, transfer and generate technology knowledge in their influence areas.

The experience in ICT strategies, need to address with high importance stimulate conducting experience with the greatest potential for replication: Mobile messaging, remote diagnosis, virtual communities, and online support, among others. As well that articulated and integrated strategies with agricultural sector and private corporations, to generate institutional synergies and alliances.

Precision agriculture for Colombia should be a priority for their productive chains, and to foster traceability in supply chain for international markets. According to the analysis of vulnerability to climate change in the agricultural sector

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<sup>57</sup> Source : Nagel, Jose, Principales barreras para la adopción de las TIC en la agricultura y en las áreas rurales- Cepal. 2012.

in Colombia, the culture located in the mountainous area of the Andean region, are most susceptible to changes in temperature, precipitation and introduction of pests and diseases that were not considered commonly in these. Moreover, those changes will affect the food security such as fruits, vegetable, potatoes, coffee and some others. With the incorporation of GIS, spatial and information systems, agricultural sector will have comparative advantages to make real-time use of the information provided by technological pathways allowing efficient recognition of suitable areas, monitoring resources uses and predict future adaptations in climate change.

Regarding different crops there's some recommendations:

Oil palm: the growth of production area will depend of the efficient use of water and soil sustainability. Therefore, GIS and other spatial information are useful to know the ability of soil and physiological development.

Sugar Cane: Technological platforms articulated with GIS and spatial information, give to farmers, the possibility to optimize natural resources and manage pests and diseases. However, sugar cane have a potential along the agricultural frontier for new planting areas, so will increase the water consumption.

Rice: monitoring spatial information as well that water consumption are the variables to take into account. It should be noted that in practice in Colombia is used almost twice as much water for rice crops to all physiological processes.

Cattle/ Livestock: Colombia challenge is to pass from an extensive cattle to an intensive cattle, now land use is around 39 millions of hectares, and public policy is looking to reduced it to 20 millones of hectares with the same amount of cattle. That is why with respect to water would change the efficient use of the resource.

## ANNEX 1 COMPLETE LIST OF PROBLEM STAKEHOLDERS

## Ministries, agencies

### In food and nutrition security

- Ministry of Agriculture and Rural Development - MARD and related bodies : INCODER , ICA, CORPOICA
- Ministry of Environment and Sustainable Development - MADS and related bodies: Humboldt Institute.
- National Planning Department - DNP
- Intersectoral Committee on Food and Nutrition Security consists of:
- Ministry of Agriculture and Rural Development
- Ministry of Health and Social Protection
- Ministry of Commerce , Industry and Tourism
- Ministry of Education
- Ministry of Environment and Sustainable Development
- Ministry of Housing, City and Territory
- Department for Social Prosperity
- Colombian Institute of Family Welfare - ICBF
- Colombian Institute for Rural Development - INCODER
- National Planning Department : DDS - DDRS

### In water

- Ministry of Agriculture and Rural Development - MARD and related bodies : INCODER , ICA, CORPOICA
- Ministry of Environment and Sustainable Development - MADS and related bodies Humboldt Institute.
- Ministry of Health and Social Protection
- Ministry of Education
- Ministry of Housing, City and Territory
- Department for Social Prosperity
- Colombian Institute of Family Welfare - ICBF
- National Planning Department : DDS – DDRS

### Knowledge institutions (CGIAR , universities )

- National University of Colombia, Universidad de los Andes, Javeriana University, University of Antioquia, Universidad del Valle, Universidad de Caldas, Universidad del Tolima.
- Research centers such as CIAT , Cenicafé Cenipalma , Cenicafé , CENIACUA , Ceniflores , Cenicel , Augura , Conif .
- Other entities, such as ACAC , CCI , COLCIENCIAS.
- Local businesses (IT services, telecommunications service providers , providers of banks ( micro insurance = MFI ) other relevant institutions such as the local FAO , the World Bank , IFAD offices and local NGOs .
- Fedesoft , the professional body of the IT sector to unionizes Industry Software and Related Information Technologies , in order to represent their interests to public and private entities , national and international level .
- American Software, ASD Group, MVM Software Engineering, Compufácil, Asesoftware, Intergroup, PersonalSoft, Consiltoía and Computer Services - CSI Services Soil and Water Engineering SA, among others.
- UNE - EPM Telecomunicaciones , Bogotá Telecomunicaciones Enterprise – ETB

## Contacts from the Netherlands - Colombian Platform



Cluster	Company
Water & Climate Services	Hans van Leenwen Royal Haskoning Deltares Arcadis Nederland BV Bluerise TA water management
Delta technology (Flood management, early warning systems, building with nature, dike works)	Royal Haskoning Mansi Jasuja Consulting Arcadis Nederland BV Water Governance Centre Dutch Water Management consulting and projects UNESCO IHE
Floating houses	Dr. Ten BV Flex Base Autark BV
Integrated urban planning and water management	Mansi Jasuja Consulting
Water Governance	Water Governance Centre All participants are interested on this cluster

TABLE 1.12: PLATFORM CONTACTS