

2015 GSDI Small Grant Project Final Report

Title of Project/Activity

GeoCommunity Galapagos: Creating a Community-Based SDI for the Galapagos Islands

Focal Point Institution

GeoCentro - Universidad San Francisco de Quito (USFQ), Ecuador (www.usfq.edu.ec)

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Summary of Deliverables as per Grant Proposal

1. Conceptual framework of the SDI Galapagos:

As a solid base of a sustainable and effective community-based SDI Galapagos a conceptual framework should take into consideration organizational and administrative concepts of inter- and trans-institutional cooperation and the provision, sharing and publication of spatial data according to standard procedures and norms. This framework serves as integrated feedback-proposal- and monitoring system for the SDI Galápagos fostering networking activities between experts, planners and citizens. For developing and applying this framework it can be resorted to the GeoCitizen-platform (<http://geociudadano.org>) that was adapted by the project team to be used as a pilot for the “GEOcommunity/GEOcomunidad Galapagos”. The GeoCitizen-platform enables citizens and citizen-initiatives to actively participate in the design and management of their living environments by reporting observations on an online-map, start discussing their observations and possible solutions, vote upon solutions and monitor their implementation. It integrates crowd-sourced data and therefore provides insights to pressing issues in the living environments of the citizens of Galápagos as and additional information layer to the proposed SDI Galápagos. The platform was tested successfully during the workshops and is planned to be implemented and promoted by the local GEOcommunity as a pilot during this year 2016 (<http://galapagos.geociudadano.org>). A usability study by volunteering members of the GEOcommunity Galapagos is under way.

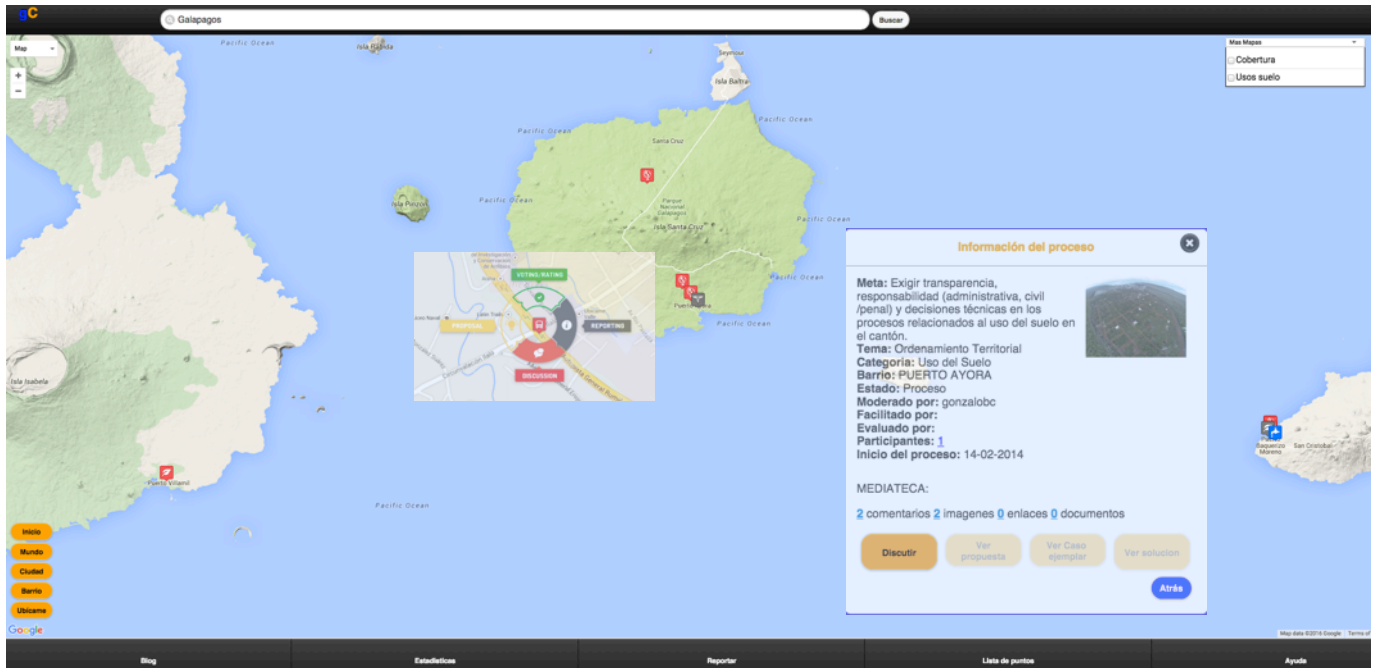


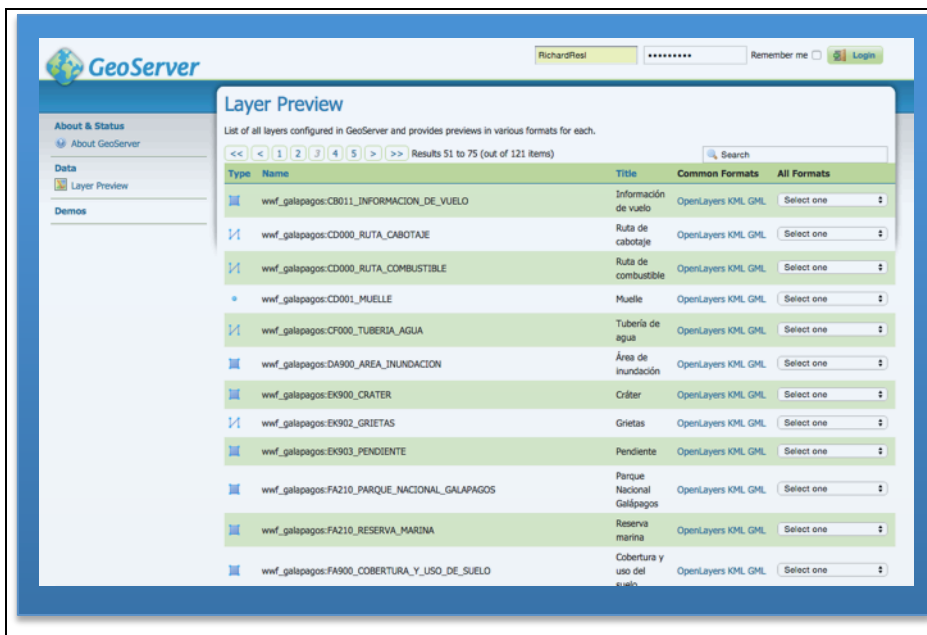
Fig.1 – Mounted screen views of the GeoCitizen Platform

One of the major activities during the workshops focused on the identification of specific procedures for implementing the SDI Galápagos. As a follow up of in-depth-discussions during the first workshop in February 2014 the following actions were carried out during the period of July to December 2015 as first steps towards a community-based SDI Galápagos:

- Launch of a **collective public relation initiative** presenting the advantages of sharing the information on geospatial resources. Public presentations carried out at the USFQ Campus Galapagos, Municipality of San Cristobal (November, 2015) and Santa Cruz (December, 2015).
- **Enhancement of communication** with regards to a shared spatial data infrastructure from governmental organizations towards identified **customers/user groups** consisting of 4 GEOcommunity board meetings with the heads/representatives of the following institutions: Consejo de Gobierno de Galapagos, Dirección Parque Nacional Galapagos DPNG, Gobierno Autonomo Decentralizado GAD de Santa Cruz, Gobierno Autonomo Decentralizado GAD de Santa Isabela, Gobierno Autonomo Decentralizado GAD de San Cristobal, and WWF; 5 specific capacity building workshops with the participation of department leaders and technicians of these institutions, including freelance professionals in GIS and IT, public health, education and energy sector, students of the Galapagos Islands and volunteers of international institutions.
- **Prototyping of a common Spatial Data Catalogue** was coordinated and generated in its first version as a proposal to be reviewed by the governmental authorities and a suggested 'Catalogue Commission', represented by local collaborators. It was designed to efficiently link to the National Spatial Data Infrastructure SNI Ecuador.
- A **harmonized metadata documentation strategy** in alignment with national/south American and international standards was implemented to create a set of prototypes for crucial spatial data themes based on ISO 19115.
- **Guidance for regulating access to and use** of spatial data sets and services (licensing) for Galápagos were discussed and will be handled by the steering committee of Open Data Access (Datos Abiertos – Secretario del Sistema Nacional de Información).

- The **common catalogue** system shall be maintained then by the Consejo de Gobierno de Galapagos in coordination with the National Spatial Data Infrastructure SNI Ecuador. A **prototype hosting** has been suggested to be carried out by one of the collaborators (University of Cuenca).
- During the workshops, the participating local organizations have started to **describe their data** in a clear, uniform and user-friendly way according to the defined metadata strategy. Further interested parties (Conservancy International CI Galapagos, INOCAR – Instituto Oceanográfico de la Armada del Ecuador, Charles Darwin Foundation Galapagos, Ministerio de Turismo Ecuador, among others) were encouraged to contribute their data descriptions to the Common Data Catalogue.
- A prototype of a web based **geoportal solution** was designed using Geoserver technology and applied during the final phase of the workshops to demonstrate the characteristics of discovering and maintaining metadata on geospatial resources of the Galápagos Islands.
- The creation of a **roadmap for sharing fundamental geographic resources** was originally foreseen to be part of the deliverables, but postponed due the limited and costly access to these media given the slow internet connections at the Galapagos Islands. Nevertheless, the different teams participating at the workshops identified crucial information for their applications disseminated through the GSDI, like image information (orthoimagery, satellite imagery), digital elevation models, digital terrain models and basemaps like OSM.

As a final result of the workshops we agreed that these actions built on the knowledge acquired and prototypes established, shall be further carried out by stakeholders of municipalities, the National Park and participating NGOs, associations and private companies, under the lead of the Consejo de Gobierno de Galapagos. Regular meetings of persons, part of the GEOcommunity Galapagos, working on the 'Data Catalogue' in their respective fields of work shall conduct this approach throughout this year 2016. A set of additional workshops, led by the Geocentro USFQ, of 6 modules working towards prototype implementations of a system architecture for SDI in two leading local organizations (GAD Santa Cruz and Dirección Parque Nacional Galapagos DPNG), were arranged.



TYPE	NAME	TITLE	COMMON FORMATS	ALL FORMATS
WFS	wwf_galapagos:CB011_INFORMACION_DE_VUELO	Información de vuelo	OpenLayers KML GML	Select one
WFS	wwf_galapagos:CD000_RUTA_CABOTAJE	Ruta de cabotaje	OpenLayers KML GML	Select one
WFS	wwf_galapagos:CD000_RUTA_COMBUSTIBLE	Ruta de combustible	OpenLayers KML GML	Select one
WFS	wwf_galapagos:CD001_MUELLE	Muelle	OpenLayers KML GML	Select one
WFS	wwf_galapagos:CF000_TUBERIA_AGUA	Tubería de agua	OpenLayers KML GML	Select one
WFS	wwf_galapagos:DA900_AREA_INUNDACION	Área de inundación	OpenLayers KML GML	Select one
WFS	wwf_galapagos:EX900_CRATER	Cráter	OpenLayers KML GML	Select one
WFS	wwf_galapagos:EX902_GRIETAS	Grietas	OpenLayers KML GML	Select one
WFS	wwf_galapagos:EX903_PENDIENTE	Pendiente	OpenLayers KML GML	Select one
WFS	wwf_galapagos:FA210_PARQUE_NACIONAL_GALAPAGOS	Parque Nacional Galápagos	OpenLayers KML GML	Select one
WFS	wwf_galapagos:FA210_RESERVA_MARINA	Reserva marina	OpenLayers KML GML	Select one
WFS	wwf_galapagos:FA900_COBERTURA_Y_USO_DE_SUELO	Cobertura y uso del suelo	OpenLayers KML GML	Select one

INFORMACION BASE						
COD	CATEGORIA	COD	SUBCATEGORIA	OBJETO GEOGRAFICO		
A	INFRAESTRUCTURA DE INDUSTRIAS Y SERVICIOS	AA	EXTRACCIÓN	Cuarteros		
		AB	INDUSTRIAS/PROCESAMIENTO	Planta de tratamiento		
		AC	AGROPECUARIA	Criadero Industrial		
		AD	ELECTRICA	Antena Industrial B Antena Industrial Central Eléctrica B Central Eléctrica B Línea de transporte eléctrica		
		AE	COMUNICACIONES/TRANSMISIÓN	Antena Estación de Comunicación Torre de comunicación Cobertura Telecomunicaciones Redonda Punto de Captación		
		AF	ALMACENAMIENTO	Reservorio Reservorio B Tanque de almacenamiento		
		AG	GESTION DE RESIDUOS	Tanque de almacenamiento B Plantamiento residuos Punto Crítico Vertedero Sitio de Recogida		
		B	GEOGRAFIA SOCIOECONOMICA	BA	ASENTAMIENTOS HUMANOS	Problema Censales Zona edificada
				BB	ASOCIADO A ASENTAMIENTOS HUMANOS	Cementerio Espacio Comarcal
				BC	COMERCIO	Mercedo
BD	EDUCACIÓN			Institución Educativa		
BE	SALUD			Unidad de Salud Cancha		
BF	RECREACIÓN			Cancha B Cancha Estadio Área Histórica		
BH	CULTURA			Sitio arqueológico Sitio histórico		
CA	TRANSPORTE TERRESTRE			Canchales Aeropuerto Aeropuerto B Intercambio de Vías		
C	INFRAESTRUCTURA DE TRANSPORTE	CB	TRANSPORTE AEREO	Intercambio de Vías Pista de aterrizaje Pista Ruta Cabotaje Ruta marítima controlada Puerto Marítimo Muelle Comunicaciones Internas Ruta terrestre controlada Caletones		
		CD	TRANSPORTE FLUVIAL/MARITIMO			
		CE	ASOCIADO A TRANSPORTACIÓN	Puerto		

Fig.2 – Excerpt of the Prototype DataCatalogue for the GEOcommunity Galapagos on GEOserver, and theme listing Attached Documents with Prototype Data Catalogue and Metadata Concept: *Catálogo de Datos_Geocomunidad Galapagos_H1 to H4.pdf; Galapagos_metadata_concepto.pdf*

The overall conceptual framework of the SDI for the GEOcommunity Galapagos includes at this initial stage the following components:

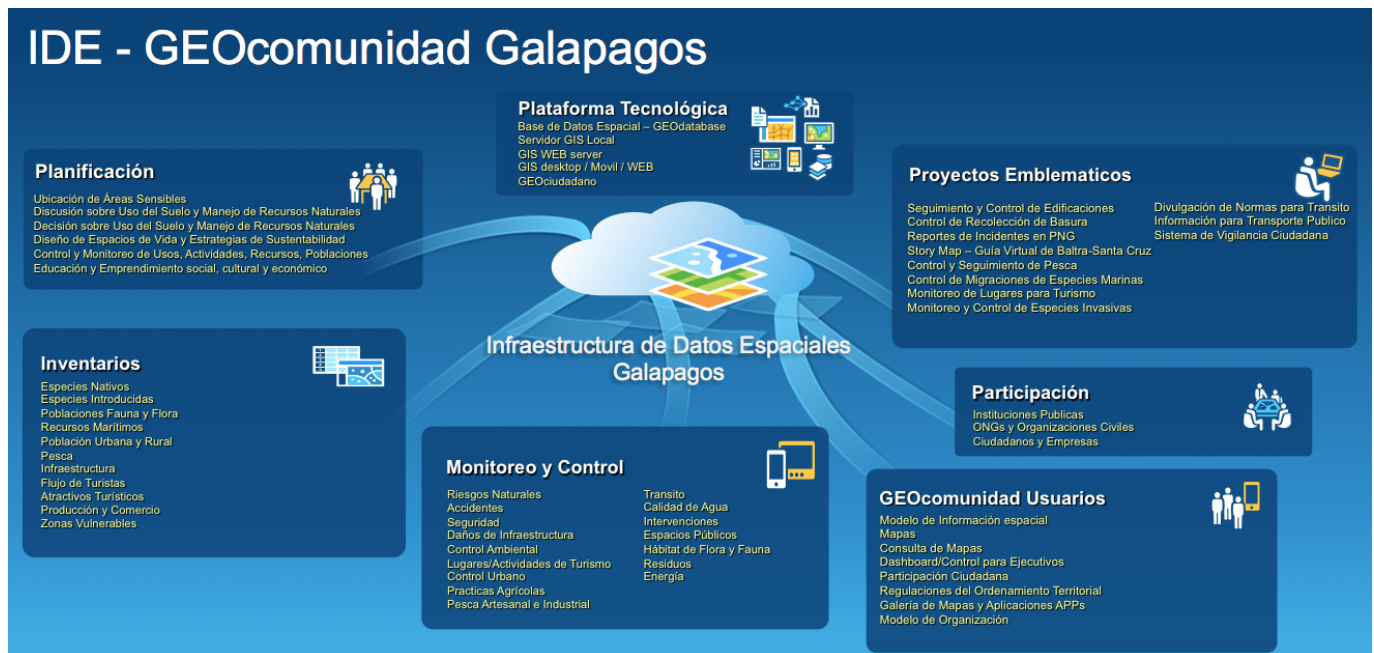


Fig.3 – Components of the Prototype SDI GEOcommunity Galapagos

2. System architecture and design:

The system architecture was carefully studied to meet both the requirements of the GEOcommunity Galapagos and the limitations encountered regarding the narrow bandwidth of internet connections on the islands. Meanwhile a web based solution is envisioned, we started out to design a distributed spatial data base concept as a first strategy and build a conceptual data model leaning towards the “GIS for the Nation” model (ESRI, 2005).

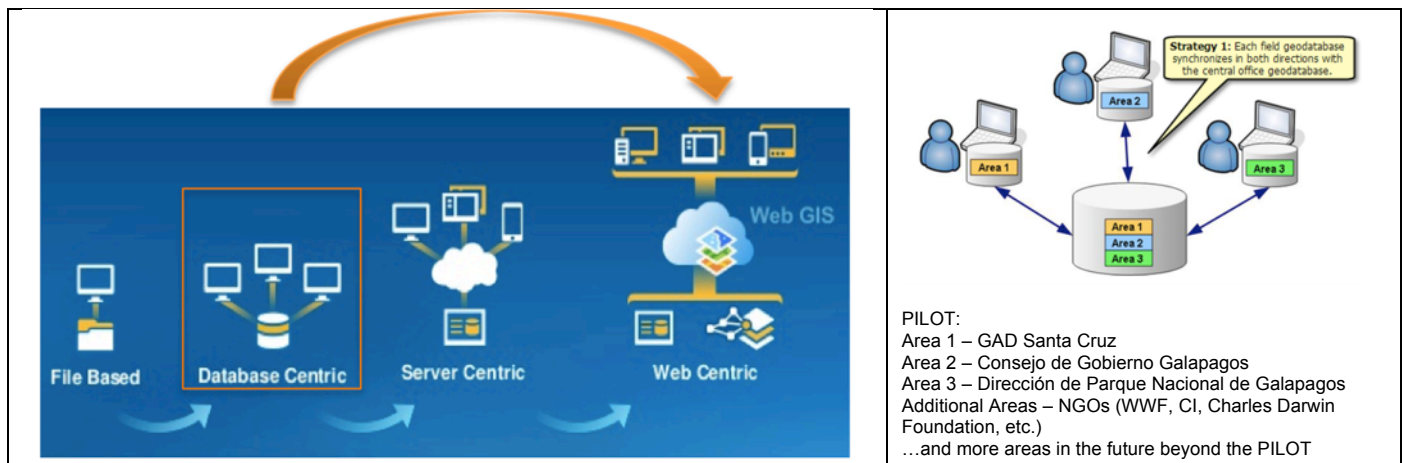


Fig.4 – GIS Architecture and Pilot of Distributed Spatial Data Base

The approach to establish not only a common data catalogue, but to enable data sharing, is considered to be successful in reaching the first goal to link datasets by creating a distributed database with a consistent replica on a local server, guaranteeing a time efficient access through one dedicated node, using Intranet connections. The local server is configured then to connect to web services hosted in the cloud, to allow for access to external data content,

map and GIS services that foster the proposed collaborative approach on building an SDI that count on specific task forces unleashed at this piloting stage by flagship applications identified by each institution. This is exactly where the local geocommunity goes global by integrating apps that work worldwide and can be easily adapted to the local needs. Mobile Apps that work on smartphone & tablets and manage asynchronous offline data management are among the most popular for the Geocommunity Galapagos at this moment.



Fig.5 – Architectural Design of SDI for both local and global geocommunity of Galapagos

The following illustration uses the exact “GIS for the Nation” data model, which was taken as a kick starter within the workshops to learn from best practices and build an overall logical database design where each institution/organization contributes with their competence on creating and managing geographic datasets in different levels of scales following standardized guidelines.

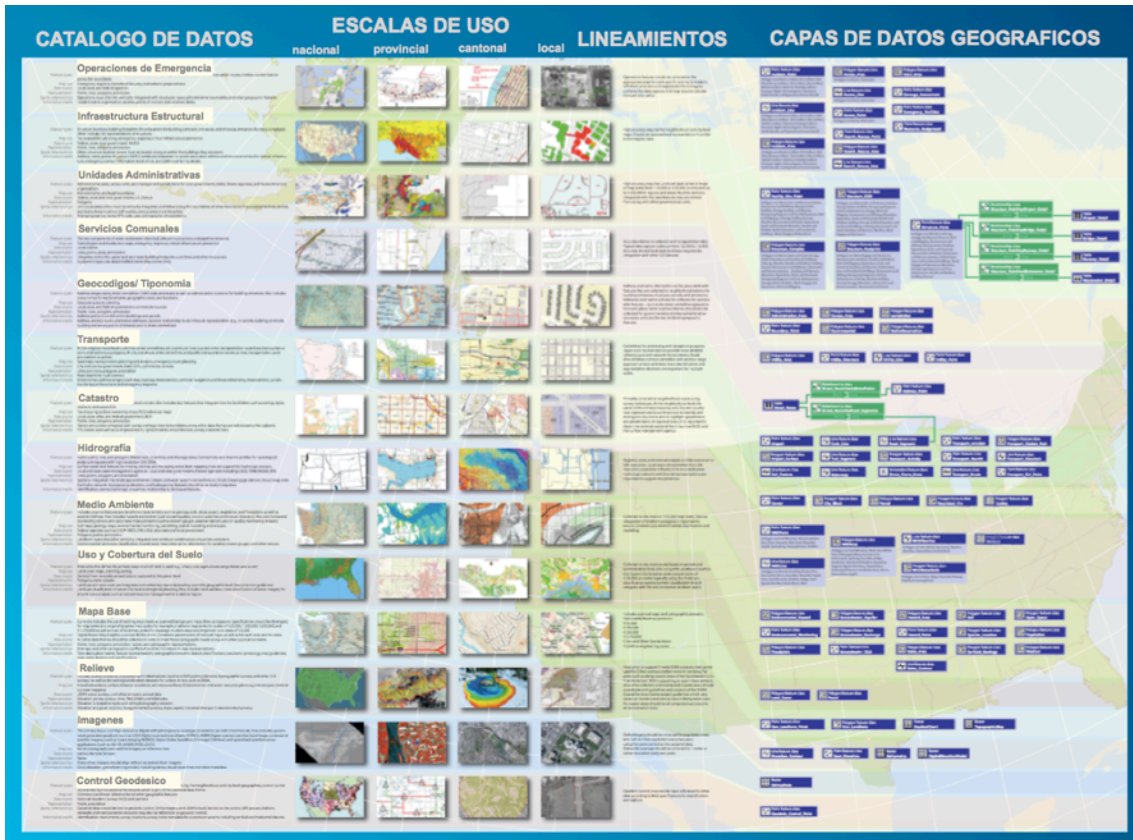


Fig.6 – Datamodel for the SDI Galapagos, adapted from “GIS for the Nation” concept

Beyond the known architectures of Web GIS services and crowdsourcing interfaces, the GeoCitizen platform is thought to be integrated increasingly in the SDI structure of the GEOcommunity Galapagos, similar to the following scheme compiling advanced APPs into one single methodological framework adding significant value of an extended community of citizens interacting with the SDI through an integrated “MetaGC” database design in development by the collaborating team.

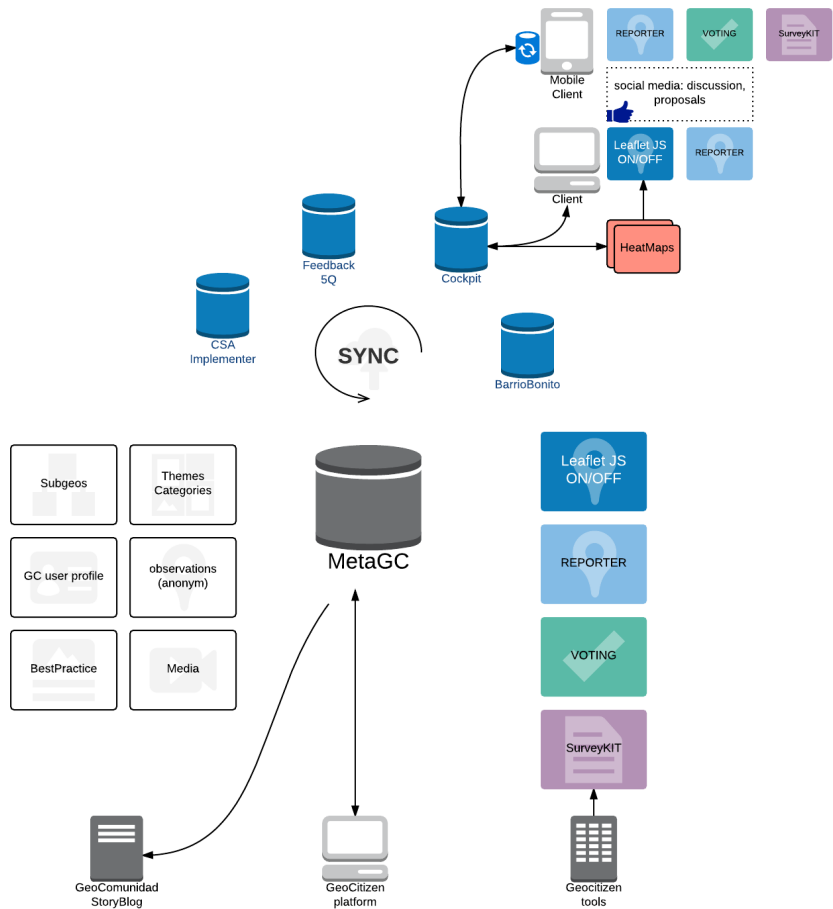


Fig.7 – GeoCitizen SDI concept in development

3. Flagship projects:

In order to bridge the gap from tedious design work to enabling a productive work force in action, phase 1 of the GEOcommunity Galapagos took in parallel the development of so called flagship projects into consideration. Throughout the workshops eleven rather simple but practical specific workflows were selected to make use of the first stages of SDI Galapagos and apply common geographic data and efficient georeferencing and mapping technologies to emblematic routines carried out by each participating member. The Geocentro at the University San Francisco de Quito made a ready to use building block for those Pilot APPs available, by configuring an access to their ArcGIS server training and research environment. The developing teams of the GEOcommunity flagship projects, additionally to their locally installed technology, can experiment with tools available through ArcGIS online, Operations Dashboard, Collector, Survey123, Snap2Map, among other ESRI products.



Fig. – GeoCitizen SDI concept in development

As the capacity building process evolves, more complexity of data analysis and modeling shall be added to this list to represent the communities overall goals and needs to manage a quite sensitive and vulnerable environment at the Galapagos Islands.

	Flagship Project Name	Objective	Coverage	SDI Tools
1	De Baltra a Puerto Ayora	Virtual journey from the main airport at Baltra crossing the island of Santa Cruz to the principal town of Puerto Ayora.	Santa Cruz	Story Map

2	Control Urbano	Control and follow up of construction regulations	Puerto Ayora	Collector + Dashboard
3	Monitoreo Especies Invasivas	Monitoring of invasive species and respective eradication measures	National Park	Collector + Dashboard
4	Control Basura	Control of waste collection and treatment	Puerto Ayora	To be defined
5	Reporte Incidentes	Reporting incidents from accidents to violations of the regulations and follow up of corresponding corrections within the national park.	National Park	App which enables offline data-capture, dashboard with indicators
6	Vialidad	Promotion of new transit regulations for citizens in order to lower impact and increase public safety and non motorized mobility	Puerto Ayora	WebApp
7	Transporte Público	Promotion of new public transport routes	Puerto Ayora	WebApp
8	Monitoreo Pesquero	Control of fishery	National Park	Collector + Dashboard
9	Monitoreo Impacto Sitios Visita	Control and follow up of environmental impacts caused along high frequency tourist paths and locations	National Park	Collector + Dashboard

10	Control Especies Marinas	Modeling of migration patterns of marine species	To be defined	Collector + Dashboard
11	Monitoreo Turismo	Monitoring of tourist activities and flows	Archipiélago Galápagos	Collector + Dashboard

Table 1 – Flagship Projects Phase 1 – SDI GEOcommunity Galapagos
 (more information – see attachment: Proyectos Emblematicos_Geocomunidad_Galapagos.pdf)

These illustrations show some of the work done during the workshops:

<p>Risk Management with Time Slider</p>	<p>Data Retrieval from GEOcommunity Galapagos GeoServer (visualizing in Google Earth)</p>	<p>Reporting Events with Collector</p>
<p>Control of Incidents with Operational Dashboard</p>	<p>Creating Story Maps directly from Mobile Apps</p>	<p>Data Capture with Collector</p>




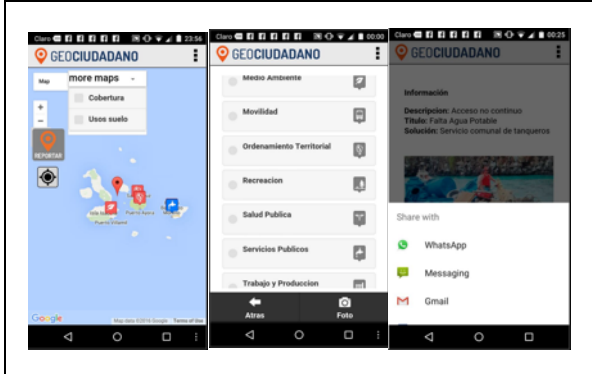
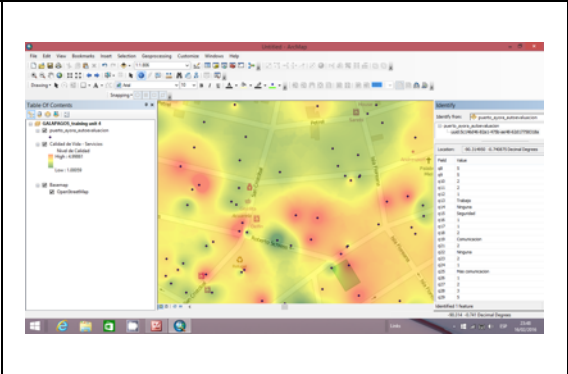
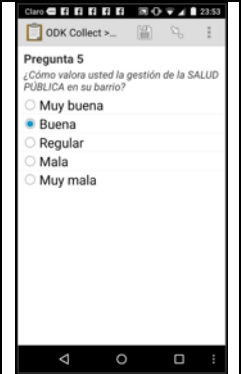
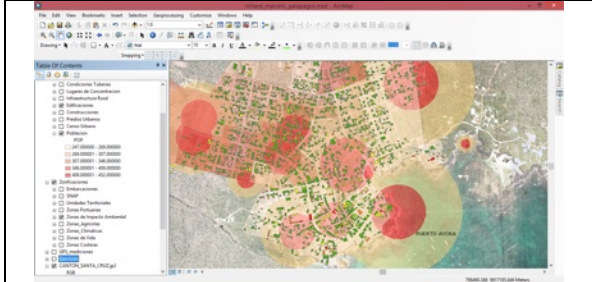
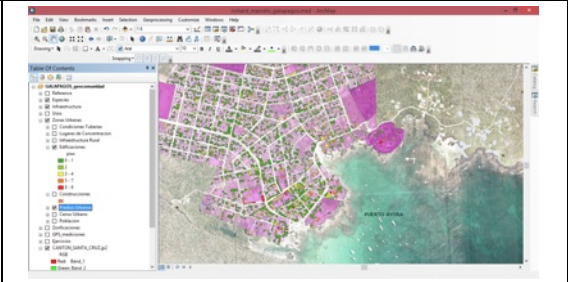


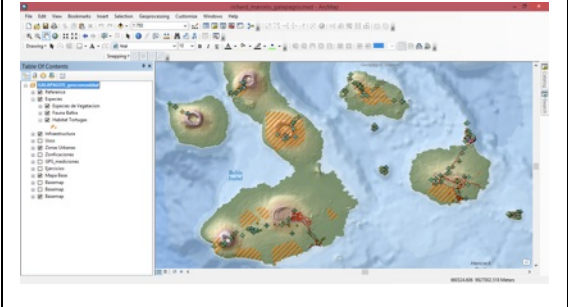
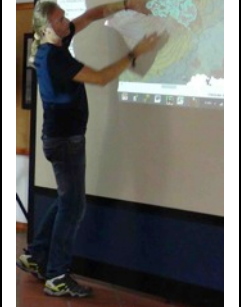
		
<p>Workshops at Galapagos Science Center USFQ San Cristobal</p>	<p>Creating Maps using the SDI Galapagos</p>	<p>Mapping Plants</p>
		
<p>GeoCitizen Reporting</p>	<p>Modeling of surveyed indicators</p>	<p>ODK – Quality of Life Self-assessment</p>
		
<p>Urban Applications – census data</p>	<p>Multipurpose Catastre</p>	<p>Building Apps</p>
		
<p>3D Modeling</p>	<p>Habitat Modeling</p>	<p>Environmental Modeling</p>

Fig.8 – Examples of Applications developed during the capacity building classes

4. Capacity building, community outreach, project documentation:

Workshops W1 – W5

		<p>WS1 SDI DESIGN DATA CATALOGUE AND METADATA DESIGN</p>
		<p>W2 ENVIRONMENTAL AND SOCIAL IMPACT MONITORING MONITORING</p>
		<p>W3 ENVIRONMENTAL AND SOCIAL IMPACT MONITORING GIS advanced INTEGRATION of APPS</p>
		<p>W4 ENVIRONMENTAL AND SOCIAL IMPACT MONITORING SPATIAL DATABASES</p>
		<p>W5 WEB GIS WEB MAP SERVICES GEO-COMMUNITY DESIGN</p>



Town hall Meeting 1

San Cristobal

Town hall Meeting 2

Santa Cruz

Community Outreach

Familiarizing international students affiliated to USFQ, GAIAS Campus with the SDI approach of the GEOcommunity Galapagos who in return used apps and data in their community work with several local students both at high-school and university level on San Cristobal Island.

Explaining the SDI Galapagos benefits to youth of the UNITED NATIONS MODEL

Fig.9 – Photo gallery of workshops

Timeline of the Project

Year	2015					2016
Month	AUG	SEP	OCT	NOV	DEC	JAN/FEB
BUILDING BLOCKS	SDI DESIGN	ENVIRONMENTAL AND SOCIAL IMPACT MONITORING			WEB GIS	GEO-COMMUNITY DESIGN
CAPACITY BUILDING (parallel Basic & Advanced Users)	DATA CATALOGUE AND METADATA DESIGN	MONITORING	GIS advanced	SPATIAL DATABASES	WEB MAP SERVICES	INTEGRATION of APPS
DEVELOPEMENT OF PILOTS (starter applications of preliminary experimental character)	GALAPAGOS SDI DATA CATALOGUE	MONITORING OF INVASIVE SPECIES and TOURIST ACTIVITIES (SMART-PHONE APP)	MODELING OF ENVIRONMENTAL and SOCIAL INDICATORS	PILOT GALAPAGOS SDI DATABASE (build on WORKSHOP RESULTS)	PROTOTYPE GEOPORTAL MUNICIPAL MULTIPURPOSE CATASTRE	USE CASES FOR INTERACTIVE PARTICIPATORY PLANNING PLATFORM "GEO-CIUDADANO GALAPAGOS"

Potential or Actual Follow-up Activities

During 2016 six more capacity building blocks are foreseen (from April to November), taking the lessons learned and prototypes in phase 1 to pilots that work in the productive environment of two selected institutions. Both the Municipality of Santa Cruz and the Headquarters of the National Park DPNG were chosen to take the lead in implementing the SDI within several areas and tasks of their institution and serve by the end of the year as a working model for the other municipalities of the Galapagos Islands and the rest of governmental agencies that generate and use spatial information frequently.

The flagship projects are under development and are aimed at expanding the use of geo-technologies and geodata, fostering a local and global collaboration on data gathering and sharing, and supporting the integration of sensitive data to improve the management of a complex and extremely vulnerable environment, which further more is of global interest.

Unanticipated obstacles you encountered

Despite the promises of national and international telecommunication enterprises and experts, the Internet bandwidth has not improved significantly throughout the last year. Furthermore governmental agencies were surprisingly reluctant in the beginning to innovations regarding open data access and collaborative approaches with civic organizations and NGOs.

Do you think you have reached your goal?

To build a geocommunity that is really on top of the rapid advances of technology is challenging. To build a solid knowledge basis to implement a sound SDI at a remote location with reduced professional human resources and tech support, is a tough goal to reach. Nevertheless, it could be demonstrated that the personal interest of young technicians and the vision of a few local leaders, supported by quite valuable strategies of NGOs, Ecuadorian and International

Universities, can breach the gap to get started and slowly but steadily make things happen in a sustainable way. The goal of getting the institutions and organizations interested and moreover involved and compromised in constructing the geocommunity Galapagos was definitely met. Still the technology and know how transfer has to increase in order to significantly empower the community and make the difference of a truly collaborative approach towards the management of a severely threatened unique environment.

Final Summary of Labor Hours spent on the project:

5 workshops of 3-4 days sum up to 18 days in classrooms and meetings, resulting in 144 direct contact hours for average 2 professionals on the islands and an additional aprox.100 hours of preparation of didactical materials and prototype development, making it a total of 388 labor hours.

Itemized Project Budget

	\$2,500 Small Grant	In-Kind Services (In USD or in Equivalent Person Days as appropriate)
Salaries and Wages		388 hours (30 USD per hour)= 11.640 USD
Travel Expenses	1.110 USD	4.230 USD
Other Direct Cost Line Items:		
Services of Technological Infrastructure for WebGIS, Installation and Configuration, Maintenance and Hosting plus printing of didactical materials.	1.390 USD	66 USD
Total Small Grant Direct Cost (must be no more than \$2,500 USD)	2.500 USD	
Total In-Kind Services		15.936 USD
<i>GSDI funds and in-kind resource cannot include hospitality costs.</i>		
<i>Examples of in-kind resources: salaries, contract support, student assistance fees, travel expenses, venue costs, software purchase, equipment dedicated to the project, computer servers hosting data, production of outreach materials, and indirect costs or overhead charges.</i>		

For more information about the GSDI or to subscribe to the GSDI News List, please see <http://gsdi.org>. For questions about this report, please contact grants@gsdi.org.