

OIE Cooperation Project

Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China

Parent Collaborating Centre

Collaborating Centre for Epidemiology, Training and Control of Emerging Avian Diseases at Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe)

Legnaro (PD) - Italy

Candidate Collaborating Centre

Chinese Academy of Inspection and Quarantine (CAIQ)

Beijing - China

2nd Annual report

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Introduction

The OIE Cooperation Project between the OIE Collaborating Centre for Epidemiology and Training on Emerging Avian Diseases (IZSVe), Parent Collaborating Centre, and the Chinese Academy for Inspection and Quarantine (CAIQ), Candidate Collaborating Centre, entitled “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China” officially started on 27th October 2014.

The main objective of the project is to allow CAIQ to acquire expertise to implement GIS applications. In order to achieve this objective, training activities on GIS management techniques, spatial analyses and GIS application development will be implemented.

GIS can be beneficial to veterinary organisations by providing a means to map data and use them for internal analysis but also to inform other organisations about their activities. In order to organise a successful GIS platform, it is necessary to integrate a well-designed GIS framework into the organisational veterinary data management system workflow. The IZSVe and the CAIQ reckon that a system that integrates spatial data with legacy data can reduce the complexity of their analysis, minimise mistakes and enhance the transparency through inter-application operability, communication and cooperation.

Background information

GIS can deliver benefits to any organisation that manages information with a geographical component. The ability of GIS technologies to capture spatial information, carry out exploratory spatial data analyses and compose cartograms can be used to support the surveillance activities of veterinary services. In particular, for the entry-exit inspection and quarantine sector activities, GIS can be used to analyse the quarantine stations and exporting farms spatial distribution, assess the presence and proximity of specific facilities (e.g.: farms, slaughterhouses, etc.) that can influence the quarantine station or exporting farm performance, valuate the environment composition that surrounds the quarantine station or exporting farm, etc.

To implement GIS projects as the one above depicted, substantial background and skills are required not only in “pure GIS discipline” but also in spatial data analysis and project management. The goal of this cooperation project, designed for technical and managerial staff working at the CAIQ, is to promote capacity building and improve their expertise on design and implement GIS applications. In particular, the cooperation project has been modulated to train the CAIQ scientists on theoretical and practical aspects of GIS technologies, explorative spatial analysis and GIS management techniques.

To improve the efficacy of the training activities, the project has been re-organised implementing a practical GIS application required by the CAIQ. The required practical application consists in the development a model-driven decision support system (DSS) bases on GIS technologies to support CAIQ in performing the quarantine station or exporting farm selection.

The activities of the second year of the project's implementation have been mostly dedicated to the introduction of the GIS technologies and some explorative spatial techniques useful for the DSS. The GIS management aspect has been less debated in this second year of implementation because both the theoretical and practical aspects were extensively presented and discussed during the DSS project design the previous year.

Phase 0: Inception Phase

The activities specified in this phase were accomplished and described in the report of the first year of implementation of the project.

Phase I: Preparatory activities

The activities specified in this phase were accomplished and described in the report of the first year of implementation of the project.

Phase II: Capacity building

The first part of this phase (Activities 2.1 - Training of two CAIQ scientists on GIS planning at the IZSve) has been described in the report of the first year of implementation of the project.

Activity 2.4 Training of the Candidate Institute GIS laboratory organisation.

The GIS laboratory training activity was mainly performed during the 4th (20-24/03/2016) and 5th (03-07/07/2016) cooperation project missions. Mission agendas and minutes are presented in annex 1 (Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission) and annex 2 respectively. The first remark on this activity is for the absence of Dr Mulatti who was institutionally committed and for this reason his mission scheduled between 20-24/03/2016 was cancelled. Meanwhile, Mr Ponzoni, Head of IZSve's EDP with proven expertise on server architecture design and implementation, was involved in this mission in order to improve the Information Technology competences of the training activities.

First mission (20-24/03/2016). The training activities of the first mission of 2016 were focused both on resolving the webGIS problems encountered by the Chinese team and the pilot dedicated to the implementation of the spatial analysis to support the risk analysis of the import and export facility selection. In order to fulfil these two tasks, the Chinese and Italian teams were split in two groups: the webGIS and pilot groups.

The webGIS group, composed of 6 scientists (2 Italian and 4 Chinese), worked for two days on resolving the server side problems arose during the installation of the software required to develop the webGIS.

The pilot group, composed of 6 scientists (2 Italian and 4 Chinese), carried out two field visits in order to test the procedure designed to perform the spatial analysis.

Two more issues were discussed during the mission: the publication of a scientific paper to present the preliminary cooperation project activities and the organisation of an international GIS course in China or Italy.

Moreover, the two teams agreed to submit a scientific manuscript to the 16th International Conference on Computational Science and Its Applications (ICCSA) with the aim to present the process put in place to study,

design and implement a spatial decision support system to support the risk evaluation of import and export facilities.

Another argument discussed during the meetings was the organisation of an international GIS courses. The basic idea about the international course was to exploit the GIS maturity level acquired by the CAIQ and, at the same time, to promote the usage of GIS among the Veterinary services of OIE Member States, university researchers, etc.

Second mission (03-07/07/2016). The training activities of the second mission were mainly linked with the participation to the 16th International Conference on Computational Science and Its Applications (ICCSA). In conjunction with the conference activities, some meetings were also done between the two teams in order to support the webGIS development and refinement, and to complete the document about the Spatial Decision Support System for the risk evaluation of import and export facilities performances.

The presentation of the first-cut Cooperation Project results at the ICCSA conference, was made by Mr Ferrè during the first day of the conference. Positive feedbacks about the scientific relevance of the activities performed to develop the Spatial Decision Support System were obtained from the conference participants. The reference to the conference proceeding is provided in the minutes document of Annex 2_e ICCSA conference.

WebGIS. The training activities to support the implementation of the webGIS application continued. Some technical issues were solved and some adjustments and tuning on the server side were proposed and evaluated. An executive summary document was issued in order to define the required steps to solve the technical impediments to put on line the webGIS application Annex 2_f Executive summary.

Spatial Decision Support System. The discussion was mainly dedicated to solve some problems related to the expert opinion exercise and the reclassification techniques. The experts involved in the projects decided to issue a document describing in detail the framework defined to develop the risk analysis (Annex 3 - Spatial decision support systems for risk analysis of the Exporting Farms)

Activity 3.4 “Report on the control measures adopted in China for controlling avian diseases”. The Chinese team informed the Italian team that the attempt to involve the Ministry of Agriculture of the People's Republic of China (in charge of animal health surveillance) in the analysis of avian disease control measures in China and in the evaluation of a possible application of GIS tools is not moving forward. There is a high probability that the results expected for this activity (Output 3.4: Report on the control measures adopted in China for controlling avian diseases) cannot be accomplished. The Chinese team will keep informed the Italian team of any progress on this activity.

Activity 2.5 Training of two Candidate Institute scientists on GIS management at the IZSVe Parent Institute.

Activity 2.6 Training of one CAIQ scientists on GIS analysis at the IZSVe Parent Institute

Activity 2.7 Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSVe Parent Institute

Activities 2.5, 2.6 and 2.7 were jointly performed during the 6th cooperation project mission (19-27/09/2016). The mission agenda and minutes are presented in Annex 4 - Training on GIS management, analysis, and zoning definition and management.

The training activities were mainly dedicated to the development of the webGIS and metadata catalogue, the refinement of the spatial decision support system developed to support the risk evaluation of the import and export facilities and the development of a conceptual model for the spatial component of Zones defined according to the OIE Zoning procedure.

WebGIS development. The Chinese and Italian teams dedicated most of the 6th mission time to test the webGIS application and resolve some minor bugs on either the server side and client side software. The result of these actions is that the webGIS application is now ready for the on-the-field test validation.

Metadata catalogue set-up. The metadata catalogue was installed and tuned in order to publish the web catalogue services (WCS). The operation was coordinated by Professor Massimo Rumor. The teams identified a bug about the Chinese language dictionary in the WCS software that led to a system crash when a Chinese lexicon is invoked by the client. A bug ticket was submitted to the GeoNetwork OpenSource Software developer team to resolve the bug. The result of the activities is that the catalogue is on-line in English Language.

Zoning conceptual model. A document entitled “Proposal for the development of a spatial data model based on the OIE Zoning procedure” was discussed and revised. (Annex 5 - Proposal for the development of a spatial data model based on the OIE Zoning procedure)

The Chinese team informed the Italian team about a currently underway process dedicated to the implementation of a Zone near Beijing for equine diseases defined according to the OIE Zoning procedure. The two teams consider this process as a good chance to test the conceptual model developed during the project activities. Moreover, the process of conceptual model transposition into a real use case can be used as a reference process for the Cooperation Project activity 3.5 (Action Plan for introducing the GIS based OIE compliant zoning strategy in China). The two teams proposed to organise a meeting in China where the project experts, the Chinese officials working on the Zoning area implementation and an international expert on Zoning can discuss about the proposed conceptual model. The Parent Collaborating Centre team will pose a specific request to OIE headquarter about the idea to organise the above mentioned meeting. Moreover, given the significant results achieved in the Zoning spatial model, both the Chinese and the Italian teams believe that they can be presented to experts from OIE collaborating centers with expertise on GIS and epidemiology.

Follow-up

Three lines have been identified as follow up actions:

- 1) The final workshop (Activity 3.6 Final workshop and press conference).
- 2) The assessment of the CAIQ GIS maturity.
- 3) The development of the Zoning spatial conceptual model.

Final workshop.

Before the end of May 2017 title, goals, participants of the workshop must be defined.

Before the end of July organisational and technical issues related to the final workshop must to be identified and discussed between the Italian and Chinese teams. An action plan will be drafted in order to define the required actions.

Assessment of the CAIQ GIS maturity and simulation exercise

In the third year an assessment of the CAIQ GIS maturity followed by an accurate simulation exercise on the capacity to implement a GIS project will be performed.

The assessment is aimed to qualify the CAIQ GIS office completeness, its organisational frameworks and the accuracy of the GIS outcomes, whereas the simulation exercise is aimed to identify levels and gaps of CAIQ GIS cooperativity. The exercise results can be used by CAIQ to evaluate and prioritize the next steps in improving GIS operations and effectiveness. However, from January 2017 CAIQ will move to the new headquarters and will have a new IT infrastructure and facilities. For this reason, it may be hard to organize and perform an effective simulation and assessment exercise for the CAIQ GIS office. It was decided to

organize a Skype conference in 2017, after the Chinese New Year, in order to check the CAIQ relocation status and find out a possible agenda to perform these tasks.

Zoning spatial conceptual model

One of the Cooperation Project outcome is the definition of a data product specification for the geographic information related to the OIE Zoning procedure. A first version of the data specification document will be drafted before the end of March. Further steps will be defined according to the reply of OIE headquarter about the request of organising a meeting with the Chinese officials working on the Zoning area implementation and an international expert on Zoning.

List of Annexes

1. Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4thmission
2. Annex 2 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 5thmission
3. Annex 3 - Spatial decision support systems for risk analysis of the Exporting Farms
4. Annex 4 - Training on GIS management, analysis and zoning definition and management
5. Annex 5 - Conceptual model of a zoning approach

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Activity 2.4.

Coaching of the Candidate Institute GIS laboratory organization - March 2016

MISSION AGENDA

Related to activity 2.4. Coaching of the Candidate Institute GIS laboratory organisation

DEPARTURE Friday 18/03/2016 - Venice airport

ARRIVAL Saturday 19/03/2016 - Beijing airport

- **DAY 1 – Sunday 20/03/2016**

Preliminary meeting to discuss about the cooperation project status after 1 year of activities.

- **DAY 2 – Monday 21/03/2016**

- Morning. Meeting at CAIQ department (CAIQ Room601, Huixinli Building No.241, Chaoyang District, Beijing) to discuss about relevant IT and organizational aspects of the project.

Participants:

ITA team - Mr Matteo Mazzucato, Mr Andrea Ponzoni, Mrs Annie Ishebabi, Mr Nicola Ferrè

PRC team - Mr Qiu Songyin, Mr Ji Fan, Mr Jiang Hongqi, Mr Jiang Ting (and his team members)

- Afternoon. The two teams (ITA and PRC) split in two groups:

- **Group A** - IT team: develop the issues related to the webGIS

ITA components: Mr Matteo Mazzucato, Mr Andrea Ponzoni

PRC components: Mr Chen Ke (CAIQ), Mr Jiang Ting (professor of BUPT) and his team members,

Activities: WebGIS development

- **Group B** – epidemiologist team: develop the protocol for the risk analysis

ITA components: Mrs Annie Ishebabi, Mr Nicola Ferrè

PRC components: Mr Qiu Songyin, Mr Ji Fan, Mr Jiang Hongqi

Activities: Revision of the risk analysis framework

- **DAY 3 – Tuesday 22/03/2016**

- **Group A** - IT team:

Activities: webGIS development

- **Group B** – epidemiologist team

Activities: meeting with the local CIQ and presentation of the draft in site data collection protocol

Transfer to the selected site 1 and perform the data collection protocol

- **DAY 4 – Wednesday 23/03/2016**

- **Group A** - IT team:

Activities: webGIS development

- **Group B** – epidemiologist team

Activities: Transfer to the selected site 2 and perform the data collection protocol

- **DAY 5 – Thursday 24/03/2016**

Meeting at the CAIQ department (CAIQ Room601, Huixinli Building No.241, Chaoyang District, Beijing)

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

- Morning.
 1. Presentation of **Group A** - IT team outcomes.
 2. Discussion and definition of an executive agenda for the webGIS implementation with a particular reference of Activity 2.3 (Training of all the relevant CAIQ staff – GIS and webGIS application)

- Afternoon.
 1. Presentation of **Group B** - epidemiologist team outcomes:
 2. Discussion and refine of the data collection protocol for the Risk analysis and Zoning implementation.
 3. Discussion about the next meeting [Activities 2.5 (Training of two Candidate Institute scientists on GIS management at the IZSve Parent Institute), 2.6 (Training of one CAIQ scientists on GIS analysis at the IZSve Parent Institute) and 2.7 (Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSve Parent Institute)]
 4. Discussion about activity 2.8 (Editing a conceptual model for developing Zoning areas in China)

DEPARTURE Friday 25/03/2016 -Beijing airport

ARRIVAL Saturday 26/03/2016 -Venice airport

MINUTES

Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization

Day 1 Sunday 20th March 2016 – preliminary meeting

09:00 – 12:00

Venue:

Beijing Courtyard Hotel (No. 37, Dongsisitiao, Dongcheng, Beijing)

Topics:

- Preliminary meeting to discuss about the ongoing status of the cooperation project after 1 year of activities
- Attendance of IZSve and CAIQ experts at international conferences
- Organisation of GIS courses
- WebGIS
- Risk analysis protocol

Participants:

<u>Italy</u>	<u>China</u>
Nicola Ferrè, Head of GIS office	Liu Xiaofei, CAIQ
Matteo Mazzucato, GIS technician	Qiu Songyin, CAIQ
Andrea Ponzoni, IT manager head of IZSve IT office	
Annie Ishebabi International Cooperation Office	

Minutes:

Mr Ferrè opened the meeting informing the Chinese colleagues that the annual report and the revised budget plan of the project (doc name: First annual report.pdf – Annex 8 Revised budget plan | date 31/05/2016) was submitted to OIE and a positive feedback was received from Gounalan Pavade, the OIE person in charge of twinning (email date: 04/02/2016).

Discussion

Article

Mr Ferrè showed a state of the art version of the manuscript “GIS application to support entry-exit inspection and quarantine activities” written by the IZSve and CAIQ experts. He proposed to Mr Songying to review together the article in order to have a consolidated version to present at the 16th International Conference on Computational Science and Its Applications (ICCSA - "GIS applications to support entry-exit inspection and quarantine activities") scheduled in July 2016 in Beijing. Mr Ferrè emphasized the importance of this initiative as a showcase where IZSve and CAIQ could present their cooperation project to an international audience and a possibility to be visible in this field for CAIQ.

Chile

Mr Ferrè pointed out the importance of sharing the twinning experience and the information of how GIS technologies could be a fundamental tool to support import/export. Thus he also proposed to Mr Songying to join GEOVET conference “Using GIS tools in a hyper connected world” that will take place at the beginning of November 2016 in Chile. The aim is to draw up an abstract putting on the spotlight CAIQ’s

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

strategy to take full advantage of GIS technologies to support entry-exit health quarantine, animal quarantine, inspection, survey, certification, supervision and administration of import-export commodities.

Organisation of international GIS course

Mr Ferrè highlighted Dr Marangon's (IZSVe Director and Project Leader at the Parent Institute) idea to organize an international course on "GIS applications on import/export issues" at the end of 2016. Mr Ferrè specified that CAIQ should be the organizer and IZSVe will provide the experts as teachers/tutors for the training course. Other administrative issues and the presentation to the OIE of the proposal as project spin-off will be discussed in the next meeting when the CAIQ managers has eventually approved the proposal.

CAIQ will be responsible for all the administrative issues. Mr Songying remarked that it will be difficult for them to contact experts from different part of Asia to attend the course. Thus Mr Ferrè proposed to ask to OIE to advertise it on its website and he added that IZSVe will do likewise on his website.

GIS course in Chinese and WebGIS

According to Mr Ferrè, when the GIS software will be ready, CAIQ's priority should be to organize a GIS course in order to train the internal staff. For this reason, Mr Mazzucato drew the attention to the WebGIS and he encouraged CAIQ experts to start arranging the Chinese version of the website to facilitate diffusion of the new technologies and its procedure of use and implementation.

Furthermore, Mr Mazzucato informed Mr Songying and Mrs Xiaofei that he hoped they will be able to work and improve together the pilot machine that he prepared. According to him, the pilot is only a tool which describes how the WebGIS could be developed but he remarked that Chinese experts will have to work to create a software that suits their special needs.

Risk analysis protocol

About the idea to develop a protocol for the risk analysis, Mr Ferrè highlighted the importance of the availability of satellite images in order to be able to identify the point of interest (POI) surrounding the quarantine stations. The aim of the risk analysis protocol is to set formally the specific steps that the local CIQ should follow in order to detect POI surrounding the quarantine station.

For the present mission Mr Ferrè suggested to focus only on the visual exercise of the identification of POI and wait for the next mission in July to introduce the safety distance calculation requires in order to detect critical POI.

Mr Ferrè briefly underlined that even in EU legislation there is not a description of the features of a quarantine station. Thus, in order to have a clear idea of what are the main features that a quarantine station should have, he suggested Mr Songying to take into consideration the OIE chapter of compartmentalization and to transpose the key elements for the quarantine station, highlighting how GIS can be used to support the activities linked with a quarantine station.

Day 2 Monday 21st March 2016 – Meeting at CAIQ Department 09:00 – 17:30

Venue:

CAIQ department (CAIQ Room 601, Huixinli Building No.241, Chaoyang District, Beijing)

Topics:

- Basemap images
- Reference system and IT issues
- Risk analysis protocol
- Organisation field visits

Participants:

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin, CAIQ
Matteo Mazzucato, GIS technician	Liu Xiaofei, CAIQ
Andrea Ponzoni, IT manager head of IZSVe IT office	Ji Fan Shenzhen CIQ
Annie Ishebabi International Cooperation Office	Jiang Hangqi Chang Qing CIQ
	Xu Gang Chang Qing CIQ
	Tang Tianyu BUPT
	Ye Min BUPT

Minutes

Basemaps images

The participants agreed on the importance of collecting basemaps images for GIS activities. Mr Ferrè underlined that web images are the main core of a GIS project and in EU these images are readily available even using Google maps. All the participants grasped that in China is more difficult to have that kind of images, therefore Mr Ferrè asked the Chinese participants if they were aware of other tools like Bing or Google China that could provide maps to CAIQ experts. Mr Ferrè renovated the request to contact the National Administration of Surveying mapping and Geo-information (NASG) agency to verify the possibility to acquire some spatial info but Mr Songyin replayed that, so far, he has never received a response.

Reference system

According to Mr Ferrè, “Reference System” is a main issue in China. In fact the one used in China (GCJ-02) creates a shift of 500-700 metres compared to the reference systems used in other countries. Thus, it is fundamental to find the right “Reference System” and a key problem is the backgrounds maps. Mr Ferrè proposed to make a survey to identify the best reference system to avoid or, at least, to reduce, the “shift problem”.

Web GIS

Mr Mazzucato presented the WebGIS pilot project that was deployed in a specific Virtual machine sent to Mr Songyin before the meeting. Mr Mazzucato reminded to Chinese colleagues that WebGIS will be useful for local CIQ to edit the relevant POIs that surround the candidate quarantine station. However, he highlighted that he prepared only a demo with basic functionalities and CAIQ experts should improve it and take the occasion to create a Chinese system using the same open source technologies or others. The choice depends on the technical analysis that is mandatory to define the IT and software best solutions.

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

Risk analysis protocol

Mr Ferrè suggested to plan a system should be suitable for their specific needs. Then he stimulated the participants to discuss possible alternative solutions in order to develop, starting from the pilot project, a brand-new system following a specific codification for POI made by CAIQ. Mr Ferrè exhorted the participants to draw up together a risk analysis procedure with the purpose to have a clear idea on how to proceed, stressing the importance of POI's identification and classification.

Discussion - afternoon

The discussion focused on the organization of the field visits to two farms scheduled for the third and fourth day. Mr Songyin underlined that he had already organized and printed the maps of the areas to be visited and he would have taken with him a GPS for the field visit exercise.

According to the expected outcomes of the project, Mr Ferrè asked if it was feasible by July 2016 to set up the server, the WebGIS application (with interface updates and the languages), to set up users from local CIQ staff and to try to implement the first "expert elicitation" in order to define the risk analysis protocol.

Day 3 Tuesday 22nd March 2016

Team A / IT team: webGIS development

09:00 – 17:30

Venue:

CAIQ department

Topics:

- Basemap images
- Reference system and IT issues

Participants:

<u>Italy</u>	<u>China</u>
Matteo Mazzucato, GIS technician	Liu Xiaofei, CAIQ
Andrea Ponzoni, IT manager head of IZSVe IT office	Tang Tianyu BUPT
	Ye Min BUPT
	Xia Chongyang Beijing CIQ

Minutes

During the day the IT team installed the virtual machine, containing the GIS system previously prepared, on the CAIQ server for the purpose to illustrate Web GIS and its functionality to the CAIQ staff.

A description of the IT network and system environment was done by CAIQ IT staff.

The first step was the installation of the system in the local server to test if it worked properly. After the setting of the Virtual machine the server booted up. A local configuration of network parameters was done in order to guarantee the right connection from GIS application, web server and database. All users and passwords were showed to CAIQ IT staff.

After the first step, a short training of the main functionalities was performed by Mr Mazzucato. Then the IT team tried to access to the GIS system in LAN and to publish the GIS services on line in web.

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

Mr Ponzoni stated the need of IT network and system support in order to shore all the activities, the security and the reliability of GIS system especially when it will be published on line.

Team B / epidemiologist team: visit to a poultry farm in the Yanqing area / data collection

09:00 – 18:30

Venue:

Field visit - Yanqing district

Participants:

Italy		China	
Nicola Ferrè,	Head of GIS office	Qiu Songyin,	CAIQ
Annie Ishebabi	International Cooperation Office	Ji Fan	Shenzhen CIQ
		Jiang Hangqi	Chang Qing CIQ
		Xu Gang	Chang Qing CIQ

Minutes

The day was entirely dedicated to the visit of the surrounding area of a poultry farm located in the Yanqing district. The aim of the field visit was to compare the information collected during the investigation of the area and inferred POI.

During the visit of the farm Mr Ferrè invited the local CIQ Mr Chongyang and the other Chinese participants to identify all the kinds of POI that they should take in consideration. Secondly, Mr Ferrè highlighted the importance to pay attention to the characteristics of the farm (e.g.: dimensions, facilities, etc.) and the surrounding environment (e.g.: land use, land coverage, etc.). Mr Songyin informed the group that the farm was currently used as a quarantine station and it imported chickens from USA.

Mr Ferrè expressed his appreciation for the location of the quarantine station. In fact he underlined that the farm was surrounded by natural barriers and nearby there were not risk elements for its biosecurity (lakes, wildlife presence, towns etc.).

After the visit, the group moved on with the identification of possible POI. Mr Ferrè reminded the group which could be a possible POI and made a list. Mr Songying asked Mr Ferrè and Mrs Ishebabi to remain in the car to avoid any kind of worries for the farmer/owner of the places that the group would visit.

The first and the second stops were two pig farms. The first one was very big (5.000 cattle) and the second was a small fattening pig farm. Both were easily identifiable on the web map.

The third stop Mr Songyin and Mr Fan were not able to check what kind of farm was. It was not visible on the map and it was possible to detect it thanks to the information provided by the farmer met during the second stop.

Instead, the fourth stop the POI was a chicken farm and the fifth was a farm that has been closed.

After the exploration of the area and POI's identification, Mr Songying expressed his satisfaction for the exercise but he underlined that the monitoring and surveillance activities are challenging above all because CAIQ has not the support of the Ministry of Agriculture. Mr Ferrè agreed with Mr Songying's thought; however he suggested to strengthen the collaboration with the local CIQ trying to delegate to them the data collection and POI identification because they can more easily collect and check directly the quality of the information.

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

In the afternoon the group visited Mr Dou Shulong, the former coordinator of the scientific activities of the Cooperation Project.

After an updating on the status of the project, Mr Dou expressed his apprehensions regarding the difficulty to source web images, the continuing absence of communication and sharing of information with the Ministry of Agriculture.

According to Mr Ferrè some of these problems could be resolved. He underlined that, until a few years ago, even in Italy web images were not free, and for this reason it is more urgent to focus the efforts where there are scope of improvement. Mr Dou and Mr Ferrè agreed on the usefulness of creating a national database with geospatial information of farms and quarantine stations with the collaboration of local CIQ.

Mr Dou expressed his intention to remain involved in the project and to ask to the new person in charge to increase the human resource involved into the cooperation project to actually achieve the set project goals.

Day 4 Thursday 23rd March 2016

Team A / IT team: webGIS development

09:00 – 17:30

Venue:

CAIQ department

Topics:

- Basemap images
- Reference system and IT issues

Participants:

<u>Italy</u>	<u>China</u>
Matteo Mazzucato, GIS technician	Liu Xiaofei, CAIQ
Andrea Ponzoni, IT manager head of IZSVe IT office	Tang Tianyu BUPT
	Ye Min BUPT
	Xia Chongyang Beijing CIQ

Minutes

The day was devoted to the upgrading the system from local/LAN dimension to web dimension.

Some difficulties were encountered during the configuration of the web server (Apache) and application server (tomcat). IIS system installed in the physical machine interacted with the web server and the all “web call to the services” to the server were redirect to the IIS listener. Most of the time was spent trying to fix the system because a system/network administrator was not present during the meeting. Eventually the CAIQ IT staff were able to solve the problem and the GIS system went online.

Each component of the GIS system was analysed. IT team was focused on:

- Web Server (Apache 2.2): it was quickly analysed because each member of the team already knew that component. The WebGIS application works on those components and all libraries were already enabled.
- Application Server (Tomcat 7): it was quickly analysed because each member of the team already knew also this component;
- Geoserver: the spatial map server was analysed in order to define and publish geographical information, to store in the Database, to expose to the web by Geo Web Services (geo WS) and to be uses by the WebGIS application as layers.
- PostgreSQL (with PostGIS): the core tables were analysed to better understand software’s mechanics and data store processing, with particular attention on “users”, “profiles” and “basic layers management” tables structure and relationships, in order to manage all the back-end operations that allow the system to work properly when data changes.

Furthermore, Mr Mazzucato showed the source code of WebGIS system to CAIQ IT staff and how to modify it in order to develop a new system more suitable to CAIQ needs. The PHP code of the main files of the application was analysed. The first part of the analysis regarded the WebGIS application structure, the

object definition (both PHP and JavaScript) and the map development functionalities. The second part regarded files' language personalization (in xml format) and data linking.

Some updates and some tests were carried out in order to understand the changed dynamics directly inside the code or in the database. Additional tests will be carried out in the next months.

Team B / epidemiologist team: visit to a poultry farm in the Yanqing area / data collection 09:00 – 18:30

Venue:

Field visit - Tianjin district

Participants:

Italy		China	
Nicola Ferrè,	Head of GIS office	Qiu Songyin,	CAIQ
Annie Ishebabi	International Cooperation Office	Ji Fan	Shenzhen CIQ
		Jiang Hangqi	Chang Qing CIQ
		Xu Gang	Chang Qing CIQ

Minutes

The second field visit was organised in Tianjin town, in the south of Beijing.

During the travel Mr Ferrè, Mr Songyin and Mr Fan discussed about exportation and animal health, Mr Ferrè remarked that it does not exist a precise list of requirements, from the geographical point of view, about the location requirements for a quarantine station.

A big cattle farm was the starting point of the second day of field exercise. In this case the aim was to verify if the POIs identified on the map had a correspondence in the reality and if the map images had lost some information.

After a first assessment of the area, Mr Ferrè praised the farm and its position. However, he emphasized that 3 km range (established by CAIQ with the aim to collect all the information about a specific farm/quarantine station) is a wide area to cover and, according to him, it is almost impossible to collect all the necessary information without a webGIS system.

The only one POI visited that day was a pig farm. As the group was collecting the info, Mr Ferrè suggested even the possibility to use a software with infrared which combines a colour analysis of the facilities. In fact he explained that this kind of software can suggest the type of facilities defining the colour of the roof. Nevertheless, Mr Ferrè specified that this kind of software is quite expensive. For this reason, Mr Ferrè renovated the invitation to Mr Songying and Mr Fan to emphasize the visual analysis, improving the relationship with the local CIQ.

At the end of the visit, Mr Ferrè and Mr Songying agreed on the necessity to start the training of the local CIQ. Mr Songying and Mr Fan proposed to introduce the use of the new software and to plan a training for 400 local CIQ.

Day 5 Thursday 24th March 2016

09:00 – 17:30

Venue:

CAIQ department

Topics:

- Outcomes of the mission, suggestions and follow-up activities
- Discussion about activity 2.3, 2.5, 2.6, 2.7

Participants

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin, CAIQ
Matteo Mazzucato, GIS technician	Liu Xiaofei, CAIQ
Andrea Ponzoni, IT manager head of IZSVe IT office	Ji Fan Shenzhen CIQ
Annie Ishebabi International Cooperation Office	Tang Tianyu BUPT
	Ye Min BUPT

Minutes

The last day was mainly dedicated to discuss the progress made during the mission and to define the next activities (meeting, conferences, courses etc.).

About the idea of GIS technology into the CAIQ frameworks, Mr Ferrè highlighted that CAIQ experts have to exploit the chance to have a pilot machine. At the same time, they should try to overcome the difficulties and improve it and start the training of part of CAIQ staff to detect POIs and to define an *ad hoc* code for them.

Mr Mazzucato underlined that GeoServer still have some security problems and that is necessary to focus on the data publication services. For this reason Mr Ferrè suggested to configure the server in a proper way paying attention to security system. Mr Ponzoni made some architecture proposal in order to develop the system and the backup procedure. Mr Ponzoni also agreed on the importance of building a safe system and he invited the CAIQ experts to consider the best practices in this field and try to set up a system adequate to their resources keeping in mind that a good system requires a good environment, service desk, backup system and, above all, change management. Starting from these assumptions, Mr Ferrè exhorted Mr Songying and his collaborators to write a document in Chinese where they have to specify their requirement analysis and the logical model in order to make their superiors aware of the best strategy identified and to pursue it.

Furthermore, according to IZSVe experts, a main problem is also the maintenance of the system that must be regenerated every 3-4 years and an approach based on project management techniques should be taken into account by CAIQ experts. Thus, even though aware of the difficulties that CAIQ colleagues have to face, Mr Ferrè invited Mr Fan and Mr Songying to draft a logical model and a consolidate version of a protocol for risk analysis and zoning implementation with the collaboration of Mr Mazzucato, exhorting CAIQ experts to think how to manage the transition from analogue to digital data collection. In closure Mr Ferrè suggested to reduce the buffer zone from 3km to 1km or 500 meters with the aim of reducing CAIQ workload.

Annex 1 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 4th mission

The discussion continued with webGIS' issues. Mr Mazzucato emphasized the importance to translate the website in Chinese in order to expand beyond their current reach facilitating the spreading of awareness and comprehension of the CAIQ's changes on GIS issues applied to surveillance and zoning in China.

About the next steps of the project, Mr Ferrè remarked the importance of CAIQ-IZSve presence at the GIS conference that will be held in Beijing on July 2016 with the aim of putting under the spotlight the collaboration between the two institutions and the growing role of CAIQ on GIS solutions.

Following the request of Mr Ferrè, the participants agreed to participate at the GIS conference at Beijing and discussing the next activities of the project [Activities 2.5 (Training of two Candidate Institute scientists on GIS management at the IZSve Parent Institute), 2.6 (Training of one CAIQ scientists on GIS analysis at the IZSve Parent Institute) and 2.7 (Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSve Parent Institute)]. Lastly they decided that the Activity 2.5 will take place at IZSve in Italy at the end of September or beginning of October 2016 and to set up in detail the other activities after the training in Italy.

Mr Ferrè thanked Mr Songying and all the other participants for the effort put in the mission. He stated that there is still a lot of work in order to develop a protocol for risk analysis and to have a Chinese WebGIS. However, even if he understands the difficulties that CAIQ experts have to face, he expressed his willingness to strengthen the cooperation between IZSve and CAIQ with the aim of achieving all the project goals. Mr Songying showed appreciation for IZSve experts and confirmed CAIQ's determination to overcome the difficulties and to achieve the results expected.

OIE Cooperation Project Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China

Activity 2.4.

Coaching of the Candidate Institute GIS laboratory organization - July 2016

MISSION AGENDA

Related to activity 2.4. Coaching of the Candidate Institute GIS laboratory organization

The proposed program consider the following activities:

- Conference participation and presentation of the preliminary results of the Cooperation Project
- Training on the webGIS implementation
- Implementing and testing the expert opinion software and procedure

DEPARTURE from Venice 01/07/2016 – 15:25

ARRIVAL in Beijing 02/07/2016 – 15:25

- **Day 1 Sunday 03/07**

Morning Revision of the conference presentation

Afternoon Discussion about the cooperation project development

- **Day 2 Monday 04/07**

Morning Attending the conference and presentation

Afternoon Attending the conference

- **DAY 3 Tuesday 05/07**

Morning Attending the conference

Afternoon Web Infrastructure check

- **DAY 4 Wednesday 06/07**

Morning Coaching on the WebGIS: implementation and test environment bug fixing

Afternoon Analysis of the risk analysis protocol weaknesses and opportunities

Analysis of possible interconnection with external information

- **DAY 5 Thursday 07/07**

Morning Setting the environment for the expert opinion

Expert opinion test exercise performing

Afternoon Meeting wrap-up and organisation of the next project activities

DEPARTURE from Beijing of IZSVe experts early in the morning 08/07/2016

MINUTES

Activity 2.4. Coaching of the Candidate Institute GIS laboratory organisation – July 2016

Day 1 - Sunday 3th July 2016 – Preliminary meeting

09:00 – 12:00

Venue:

Park Plaza hotel (Park Plaza Beijing Science Park, Haidian District, Beijing)

Topics:

- discussion about the ongoing status of the cooperation project
- revision of mission agenda according to the latest changes of the conference program
- discussion about the conference presentation

Participants:

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin CAIQ
Matteo Mazzucato GIS technician	

Minutes:

Mr Ferrè opened the meeting by reviewing the latest activities carried out by the Italian team. Ferrè informed the Chinese colleagues about the submission of the scientific paper entitled “GIS applications to support entry-exit inspection and quarantine activities”, which has been included in the proceeding of the ICCSA conference (see 2_a “ICCSA proceeding”). Moreover, Ferrè informed that also the abstract entitled “A GIS framework to evaluate spatial factors that affect the selection of animal quarantine stations in China” submitted to the next GeoVET conference (GEOVET 2016 – Universidad Austral de Chile, Valdivia, Chile; 7th – 11th November 2016) has been accepted for an oral presentation, see GeoVET proceeding (see d.a. 2_b “GeoVET - A GIS framework for evaluation of spatial factors that affect the quarantine station”). Since members of the Chinese team are also co-authors of the abstract Ferrè asked Mr Songyin if it was possible to repeat the positive experience linked to the study and composition of the presentation presented at the ICCSA conference. Mr Songyin reply that he need to discuss about this proposal with his managers.

Mr Mazzucato presented the changes made to the Cooperation Project web site (<http://gis.izsvenezie.it/cooperation/oie/izsve-caiq/index.php>) according to the instruction provided by the OIE. Moreover Mazzucato presented the list of the documents (see d.a. 2_c “Tech phases - milestones”) to verify the status of the IT infrastructure dedicated to the web GIS that has been checked during the 3rd day when the two teams will work on the web GIS project.

Mr Songyin presented the progress made by the Chines team with particular reference to the web GIS project. Mr Songyin informed the Italian team that the transfer of the department to the new location has encountered some delays that caused the postponement of the installation of the new server acquisition to host the web GIS in the server farm room of the new facility. Moreover, the Chinese team in charge of the web GIS development encountered some difficulties in the code development that required the vis-à-vis

Annex 2 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 5th mission

support of the Italian team in order to detect and resolve the pending bugs. Mr Songyin expressed his hope to resolve pending bugs during the mission in order to proceed with the next project phases dedicated to the system test and training course (Activity 2.9 Training of all the relevant CAIQ staff – GIS and webGIS application).

Mr Ferrè presented a document about a pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China (see d.a. 2_d “A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China”). The document, that has been edited according to the outcomes of the field visits of the previous mission (Minutes mission March 2016, from 20/03/2016 to 24/03/2016), aims to provide a technical framework to implement the process of spatial factor evaluation for the candidate quarantine station. Mr Songyin asked to discuss the proposed document during the next days in order to present it to the other Chinese colleagues.

Mr Ferrè presented the final version of the presentation that has been presented the day after at the ICASS conference. The two teams reviewed the presentation and made some changes. Mr Songyin expressed his perplexity to make a joint presentation and asked to Mr Ferrè to present it only by himself.

Day 2 – Monday 4th July 2016

09:00 – 18:30

Venue:

Park Palace Hotel

Topics:

- attending the conference

Participants:

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin CAIQ
Matteo Mazzucato GIS technician	Ji Fan Shenzhen CIQ

Minutes

According to the conference program, Mr Ferrè made the presentation (see d.a. 2_e “ICCSA conference”). During the question time following the presentation, it was asked (i) the status of the presented framework implementation, and (ii) if the framework has been recognised as an “official” tool.

About the first question, Mr Ferrè replied that the framework is one of the outcome of the Cooperation Project and its major result is the capacity building on GIS maturity for the AQSIQ. Therefore “the framework can be seen as one tool, a useful tool, but the major effort by the two teams is to put on the GIS capacity building as whole”. Mr Ferrè added also that the framework is composed essentially by two components: the risk analysis and the web GIS. The risk analysis is almost completed and in the next months, the testing and validation phases will take place. About the web GIS, some difficulties have been encountered about the programming and script aspects but they are going to be resolved.

Annex 2 - Activity 2.4. Coaching of the Candidate Institute GIS laboratory organization – 5th mission

About the second question, Mr Ferrè informed the audience that the elements used for the risk evaluation were derived by an AQSIQ official document. The same elements were also used to design the framework. Ferrè expressed the idea that “the framework is built to perform the same activities with the same elements but adding also tool and a structured method of spatial analysis in order to improve the reliability and confidence of the analysis outcomes”.

The rest of the day the teams attended the various scientific presentations made by other conference delegates.

Day 3 Tuesday 5th July 2016

09:00 – 12:30

Venue:

Park Palace Hotel

Topics:

- attending the conference

Participants:

Italy	China
Nicola Ferrè, Head of GIS office	
Matteo Mazzucato GIS technician	

Minutes

During the morning, the Italian team followed some scientific presentations made by the conference delegates.

Day 3 Tuesday 5th July 2016

14:30 – 17:30

Venue:

CAIQ department

Topics:

- web Infrastructure check

Participants:

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin, CAIQ
Matteo Mazzucato, GIS technician	Ji Fan Shenzhen CIQ
	Tang Tianyu BUPT
	Ye Min BUPT

Minutes

Mr Mazzucato described the elements related to the infrastructure and application architecture included in the WebGIS checklist. The two teams went through the list and fixed the missing elements. In addition, some issues related to the base map layer were fixed. At the end of the day all the elements were checked and accomplished.

The evaluation of the entire checklist took more time than planned in the mission agenda, therefore the “Analysis of the risk analysis protocol, weakness and opportunities”, “Analysis of possible interconnection with external information”, and “Coaching on the WebGIS implementation web platform status” tasks were postponed to the day after.

Day 4 Wednesday 6th July 2016

09:00 – 17:30

Venue:

CAIQ department

Topics:

- Coaching on the WebGIS implementation web platform status
- Analysis of the risk analysis protocol weakness and opportunities
- Analysis of possible interconnection with external information

Participants:

<u>Italy</u>	<u>China</u>
Nicola Ferrè, Head of GIS office	Qiu Songyin, CAIQ
Matteo Mazzucato, GIS technician	Ji Fan Shenzhen CIQ
	Tang Tianyu BUPT
	Ye Min BUPT

The first part of the day was dedicated to coaching on the WebGIS implementation web platform status. The two teams evaluated the script developed by the Chinese team and tried to fix some identified bugs.

The second part of the day was dedicated to the “Analysis of the risk analysis protocol weakness and opportunities”, and to the “Analysis of possible interconnection with external information”.

Mr Ferrè presented to the whole participants the document “A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China”(see d.a. 2_d) . The discussion was concentrated essentially on the expert opinion framework that has been proposed to use for the definition of the importance of the elements used for the spatial evaluation.

The other topic discussed was the possibility to integrate information from other source of data. Mr Fan described the project that has been defined to collect and manage the information about the animal movements form and to the quarantine station. Mr Fan informed the two teams that the project was under evaluation by the AQSIQ managers and he expected to get a positive feedback before the end of autumn 2016. The scientists considered the opportunity to integrate the information of the new coming system into the WebGIS, and vice versa, a good opportunity to maximize value of the collected information and it has been proposed to evaluate the possibility to expand the Project activity with one sub-task dedicated to data integration.

Day 5 Thursday 7th July 2016

09:00 – 12:30

Venue:

CAIQ department

Topics:

- Setting the environment for the expert opinion
- Expert opinion test exercise performing
- Meeting wrap-up and organisation of the next project activities

Participants

Italy	China
Nicola Ferrè, Head of GIS office	Qiu Songyin, CAIQ
Matteo Mazzucato, GIS technician	Tang Tianyu BUPT
	Ye Min BUPT

Minutes

The two teams worked to set the environment to install the software that should be used to perform the expert opinion. The software, called Expert Choice, required an old version of Microsoft (the Microsoft XP) in order to be installed. A virtual machine was set and configured on Mr Songyin's personal computer, then the software was successfully installed.

Ferrè described the theoretical aspects of the Expert Choice software, while Mazzucato described the technological operations to perform the expert opinion exercise. Then a simulation exercise was performed by the Chinese team supported by the two Italian scientists.

Moreover, the Mr Songyin clarified that CAIQ do not perform activities dedicated to the control of avian diseases in China, because these are in charge of the Ministry of Agriculture (MoA). The attempt made by CAIQ to involve the MoA in the project in order to acquire the information on farm spatial distribution has failed so far. They consider quite unlikely the chance to "create" a joint activity between IZSVE, CAIC and MoA in order to produce a report on the control measures adopted in China for controlling avian diseases before the end of the Cooperation Project.

The final part of the meeting was dedicated to wrap-up and final remarks. The "Executive summary" document was edited and approved by the participants (see d.a. 2_f "Executive summary"). In particular, the main issues discussed were:

- The web GIS system is expected to be completed before the end of the year in order to start with the testing and validation process.
- A course on the web GIS and its functionalities (Activity 2.9 Training of all the relevant CAIQ staff – GIS and webGIS application), will be organised by the CAIQ in March-April of 2017.
- A workshop dedicated to the expert opinion exercise will be organized by the CAIQ in March-April of 2017. During the workshop the IZSVE scientific Director – Project Leader, Dr Stefano Marangon, will discuss with the CAIQ and AQSIQ managers about the project outcomes and the organisation of the final workshop (Activity 3.6 Final workshop and press conference).

LIST OF DOCUMENTS ATTACHED (d.a.)

Related to activity 2.4. Coaching of the Candidate Institute GIS laboratory organization

- d.a. 2_a ICCSA proceeding
- d.a. 2_b GeoVET - A GIS framework for evaluation of spatial factors that affect the quarantine station
- d.a. 2_c Technical phases – milestones
- d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China
- d.a. 2_e ICCSA Conference
- d.a. 2_f Executive summary

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Part III



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GIS Applications to Support Entry-Exit Inspection and Quarantine Activities

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Abstract. This paper presents the outcome of a project aimed at developing a system for the management of the information flow regarding the approval and supervision of pre and post-arrival animal quarantine station. In particular, the paper outlines the project strategies and issues identified during the implementation process of a GIS based application in an organisation characterised by a low level of GIS maturity. The tools used for the Business Case evaluation, the assessment of the organisational and technological capacity, the architecture of the webGIS application used for the pilot study and the protocol developed for the quarantine station performance evaluation are presented.

Keywords: Quarantine station · Veterinary · Visual exploratory spatial analysis

1 Introduction

The importation of animals and animal products involves a degree of risk to the importing country represented by the introduction of animals affected by diseases already present or not in the country. However, the threat of disease introduction has been used in some instances to enforce stringent national measures (e.g. import bans) designed primarily to impair trade and protect local livestock industries [1]. In order to achieve a balance between free trade and the protection of human and animal health, the World Organisation for Animal Health (OIE) has defined a set of standards for international trade in animals and animal products. The OIE is an organisation recognised by the World Trade Organization that operates within the framework of the Agreement on the Application of Sanitary and Phytosanitary (SPS).

Measures [2] for commodities derived from livestock [3]. One of the key aims of the OIE standards is to reduce the information gap between importers and exporters by seeking a formal and consistent approach to the assessment of disease risks associated with trade. Therefore, the OIE has developed a set of guidelines to assess risks associated

with trade in animals and their products, known as import risk analysis¹ (IRA). IRA seeks to reduce a complex underlying process for instance, the introduction of a pathogen to a susceptible population leading to a significant impact on the population, to an understandable and accurate abstract representation [4]. One of the key component of IRA is the release assessment². The release assessment is represented by the description of the biological pathway(s) necessary for an imported commodity to ‘release’ (that is, introduce) pathogenic agents into a particular environment. Among the factors³ that should be taken into account in the release assessment, there is the evaluation of the quarantine station performance. A quarantine station is an establishment under the control of the veterinary authority where animals are maintained in isolation with no direct or indirect contact with other animals. The role of a quarantine station is to ensure that there is no transmission of specified pathogen(s) outside the establishment while the animals are undergoing observation [5]. In China, the supervision and administration of the quarantine stations is in charge of the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ). AQSIQ is responsible for the control of animals and their products which enter or leave China. This includes checks on imported animals, quarantine and certification of animals to be exported. AQSIQ is a central governmental body, with provincial (CIQ) and local branches. Two types of quarantine station are present in China: the quarantine station set up by the AQSIQ and the quarantine station designated by CIQ. According to the AQSIQ decree 122/2009⁴, the location of the quarantine station shall comply with standards and requirements issued by AQSIQ. These standards and requirements have the scope to ensure that the station functional boundary provides an adequate separation of housed animals from the surrounding environment. With a view to improve the framework for the evaluation of the quarantine station performance and the related administrative framework, the Chinese Academy of Inspection and Quarantine (CAIQ⁵) has recently launched a project to develop a framework for the management of spatial and no-spatial data of quarantine station. The project called “MoEWebGIS” (MoE) will be developed under the activities of the OIE cooperation project entitled “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China” (<http://gis.izsvenezie.it/cooperation/oie/izsve-caiq/index.php>). The MoE project has been envisaged during the

¹ Risk analysis is an approach to assess both the likelihood and consequences of undesirable events, known as hazards, and used to support decision-making in the face of uncertainty.

² The risk assessment process consists of four interrelated steps: (i) Release assessment, (ii) Exposure assessment, (iii) Consequence assessment, and (iv) Risk estimation.

³ The factors considered in the release assessment analysis are: biological (i.e. species, quarantine), country (i.e. incidence, prevalence), and commodities (i.e. quantity of commodities, effect of processing) [5].

⁴ Decree of General Administration of Quality Supervision, Inspection and Quarantine of the People’s Republic of China No. 122 “Administrative Measures for the Supervision on the Use of the Quarantine Station of Entry animals” of October 22, 2009.

⁵ CAIQ is a national public institute that provides technical support to the policy-making related to inspection and quarantine for China’s central government, and provides technical assistance to the law enforcement duties of the AQSIQ.

workshop entitled “GIS applications to support entry-exit inspection and quarantine activities” held in GuangZhou (CHN) on the 14–15th May 2015 and organised by CAIQ. The present paper aims at providing the preliminary results of the MoE project.

2 Methods

For the development of the MoE project the classical waterfall schema has been used [6, 7]. In this paper, the results obtained in the Planning, Analysis, and (partially) Design steps are presented.

For the planning step a Business Case reduced schema derived from the PRINCE2⁶ method has been implemented. The schema used consisted of the following elements:

- **Executive Summary:** highlights the objectives and the key points of the project including also the main benefits expected from the system.
- **Reasons:** defines the reasons for undertaking the project and explains how the project will enable the achievement of objectives.
- **Business Options:** analysis and reasoned recommendation for the possible options of do nothing, do the minimal or do a complete system.
- **Expected Benefits:** the benefits that the project will deliver with respect to the situation as it exists prior to the project.
- **Expected Dis-benefits:** outcomes perceived as negative by one or more stakeholders.
- **Timescale:** the period over which the project will run.
- **Costs:** A summary of the project costs (including maintenance costs) and their funding arrangements.
- **Major Risks:** a summary of the key risks associated with the project.

For the Analysis step the Use case analysis [8] combined with the As-Is analysis, the Requirement analysis, and the Gap analysis have been adopted.

For the assessment of the CAIQ GIS organisation and technological capacity included in the As-Is analysis, a simplified version of COBIT⁷ domain PO (Plan and Organize) integrated with the typical GIS elements, has been used. In particular, the following elements have been evaluated:

- PO2 - Define the Information Architecture (with particular reference to the metadata and data dictionary).
- PO3 - Technological Direction (with particular reference to the assessments of the current vs. planned information systems).
- PO4 - Define the Information Technology Processes, Organisation and Relationships (with particular reference to skills and experience in GIS technologies).
- PO7 - Manage IT Human Resources (with particular reference to personnel expectation and training programme identification).

⁶ PRINCE2: acronym for PRojects IN Controlled Environments - <https://www.prince2.com>.

⁷ Control Practices: Guidance to Achieve Control Objectives for Successful IT Governance (2nd Edition).

To illustrate the outcome diagrams the software Enterprise architect (Enterprise Architect Ultimate Edition version 10.0 Sparx System) has been used.

For the Design step a pilot project has been designed. The pilot has been structured in the following three elements:

- (a) Protocol for data collection.
- (b) WebGIS for data editing and presentation.
- (c) Protocol for data analysis.

For the definition of the protocol for data collection, a series of interviews have been conducted during the capacity building activities of the already mentioned OIE cooperation project⁸.

For the webGIS, a webGIS platform already developed by the Italian team in a past project, has been adapted and deployed for this specific pilot. The architecture of the platform is illustrated in Fig. 1.

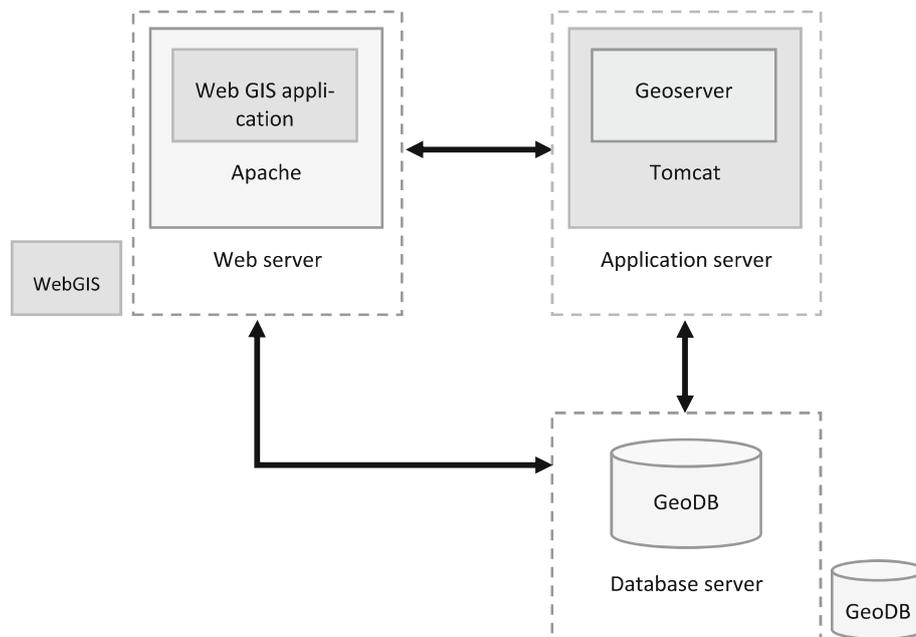


Fig. 1. Web GIS architecture

For the data analysis protocol, the sequence of steps is presented in Fig. 2. The protocol is based on the Simple Additive Weighting (SAW) process [9]. The SAW method is based on the concept of a weighted average in which continuous criteria are

⁸ Respectively Phase 1: Preparatory activities - Activity 1.2 Baseline assessment of CAIQ GIS organisation and capacity Phase 2: Capacity building - Activity 2.1. Training of two CAIQ scientists on GIS planning at the IZSve Parent Institute.

standardized to a common numeric range, and then combined by means of a weighted average in order to obtain a score. In our context:

- The criteria are represented by a set of features called Point of Interest (POI). The POIs are premises that directly or indirectly can be exposed to a disease problem derived from the presence of animals in the quarantine station. The list of POIs includes: (i) flocks or herds, (ii) animal hospitals, (iii) animal markets, (iv) slaughterhouses, (v) veterinary research institutes, (vi) rendering plants, (vii) fur and leather plants, (viii) artificial insemination stations, (ix) embryo transfer stations, (x) bio-safety disposal stations, (xi) human hospitals, (xii) border posts, (xiii) animal storage depots, and (xiv) airports and ports with an animal transfer area.
- The score, called “Total Impact”, is obtained by multiplying the importance weight assigned to each POI class with the classified value of the observed POI and then summing the products over the POIs that fall inside the study area (area of 3 km radius surrounding the candidate quarantine station).

$$Total\ Impact = \sum w_i x_i \times \prod c_j$$

Where:

Total Impact = is the impact associated to the POI distribution in the area that surround the candidate quarantine station.

w = is the weight for the *i* type of POI

x = is the intensity of the observed *i* POI. The intensity is a quantifiable measure and represents the dimension of the POI. For example, the intensity for the “farm” class of POI is its size (number of animals), for a hospital the number of beds, etc. The values are then re-classified according to a defined range values (i.e.: from 1 to 7)

c = Boolean constraint. Take into account the “critical POIs”. The critical POIs are the class of POI that shall not be near a quarantine station. The presence of a critical POI in the area that surrounds the candidate quarantine station leads directly to reject the request to become a quarantine station.

- The weights of relative importance for each class of POIs, at the moment of the paper submission have not been calculated yet. The weights will be calculated by means of a pair-wise comparison method performed by a panel of CAIQ experts during an expert opinion exercise.

The Total Impact will be compared with a defined threshold value defined by means of an exploratory spatial data analysis. If the impact is above the threshold, the request to become a new quarantine station will be rejected. The threshold value will be defined by means of a scenario analysis. A series of possible POIs distribution (scenario) will be presented to a panel of CAIQ experts during an expert opinion exercise. For each scenario the experts will formulate a judgement that could be (i) approved, (ii) rejected, (iii) more analysis are required. The expert judgements will be then combined to derive the threshold value.

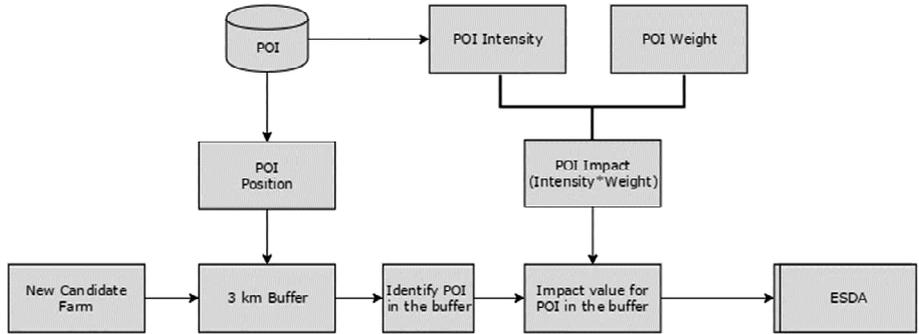


Fig. 2. Protocol for the data analysis

3 Results

The MoE project has been initiated without a formal request for proposals. Therefore, the first step taken by the Chinese and Italian teams that are involved in the OIE cooperation project has been the preparation of an unsolicited proposal. The proposal, written in form of a Business Case document in both English and Chinese languages, used a

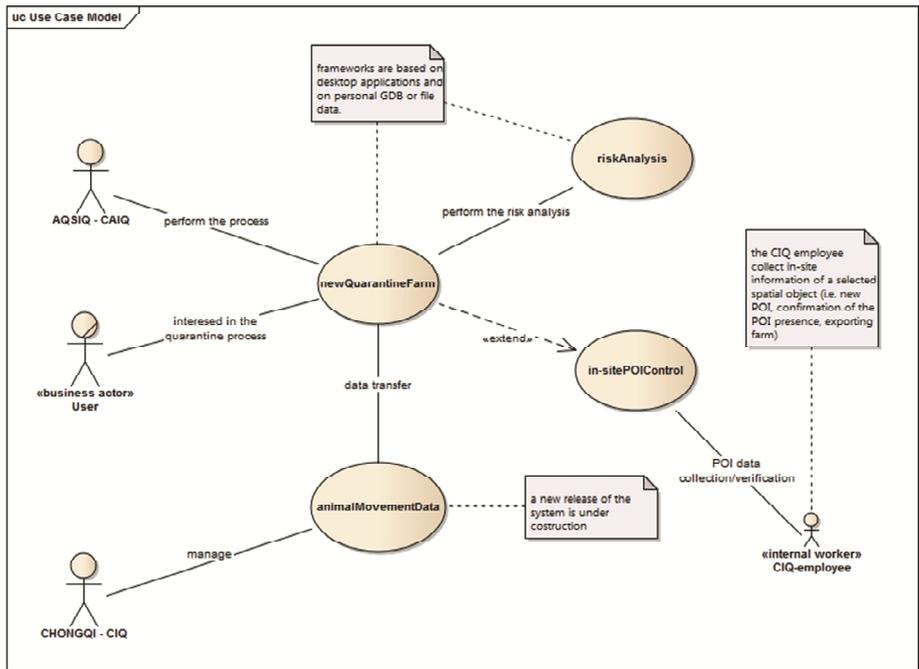


Fig. 3. As-Is analysis - Quarantine Farm approval use case diagram

“simple” language and avoided Information Technology (IT) or GIS specific terminologies. The document has been submitted as an internal document to inform decision-makers of what activities lie ahead and what funding will be necessary. The result of this step has been a commitment from the senior management to proceed with the Analysis and Design phases.

The first activity for the Analysis step has been the assessment of the GIS activities performed by CAIQ for the management of the information flow regarding the approval and supervision of pre and post-arrival quarantine stations. The assessment has been performed by the Italian team composed by a GIS manager, a GIS technician, and a Veterinarian expert in spatial analysis. The team focused its assessment on the most critical resources needed to implement the requested actions, and in particular, on the: (i) GIS office organizational structure, (ii) available spatial data, (iii) GIS applications already in use, (iv) IT infrastructure, and (v) Familiarity on GIS techniques and spatial statistical analysis. The result of the assessment⁹ highlighted the necessity to implement the MoE project in order to improve the information flow and quality.

The next step has been the development of the As-Is analysis. From the assessment exercise, the As-Is analysis has been derived. The analysis identified and described (i) layers, (ii) GIS functions, (iii) impact, and (iv) quality of information used by the CAIQ operator for the management of the information flow regarding the approval and supervision of pre and post-arrival quarantine stations. In the As-Is analysis, a principal use case called “Quarantine Farm approval” (Figs. 3 and 4 present, respectively, use case diagram and activity diagram) has been identified. In the use case, the key role of the POI and the on-site action aroused. In particular, the on-site action is of particular importance for the evaluation process because it influences the level of data quality (i.e. completeness, spatial accuracy) and therefore, the reliability of the analysis outcomes (Fig. 5).

The next step has been the development of the First-cut functional analysis. The following classes of functionalities have been identified:

- The new system should be developed on a web-based architecture in order to allow the local CIQs distributed all over China, to access the system functionalities.
- The system should be developed using a service-oriented architecture in order to allow the interoperability with the new coming CAIQ systems.
- The risk analysis component shall be performed in a desktop GIS session and based on a well-defined framework that string together sequences of geoprocessing tools.
- The POI update activity should be performed on a specific survey plan, and based on a well defined framework that shall include a tailored training session for the local CIQ.

Based on the outcome of the As-Is and the first-cut functional analysis, a gap analysis has been developed. The gap analysis has allowed the identification of the function requirements that could not be met by the system previously in place. The following classes of gaps have been identified:

⁹ The results of the assessment exercise is a proprietary and confidential document, therefore it is not possible to disclosed it in any part.

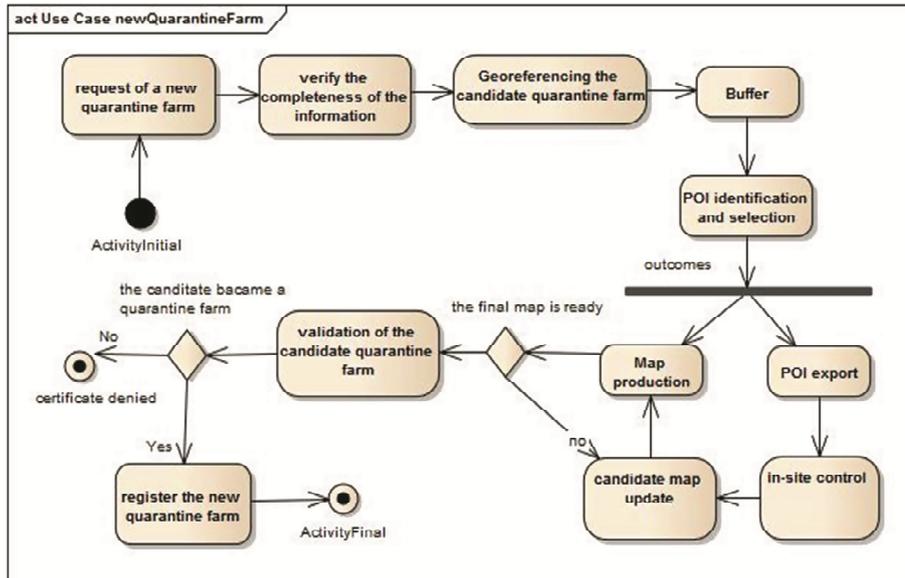


Fig. 4. Activity diagram of the Quarantine Farm approval use case

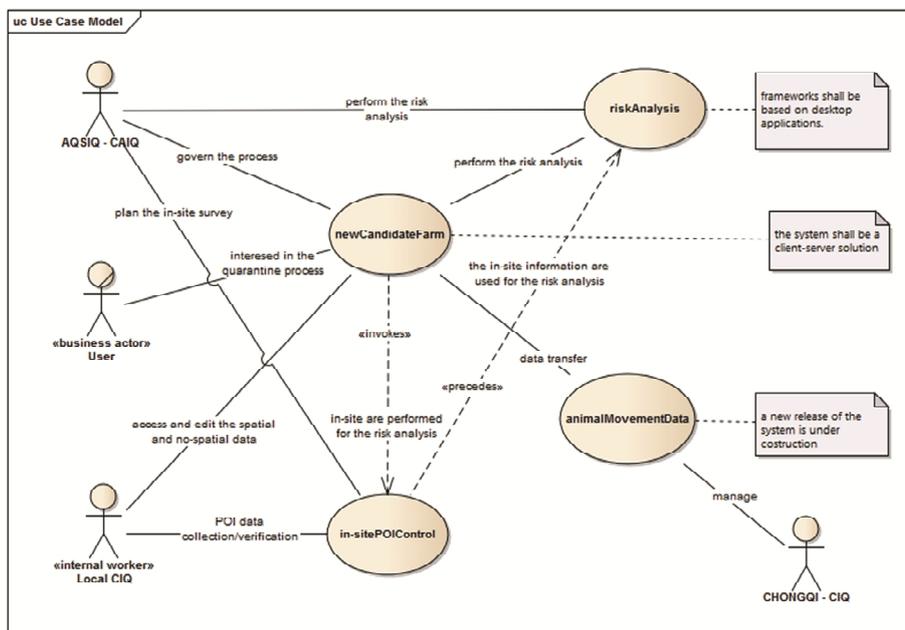


Fig. 5. Quarantine station location analysis use case

1. To shift from a no-structured framework toward a well-know process based on a structured data collection and flow.
 - The database schema shall be documented and tested.
 - The system shall control as much data flow as possible. This means that the data editing shall be done through a web system interface or uploaded through a web service or a well-known file schema.
2. To transpose the primary actor of the process from CAIQ to the local CIQs.
 - The local CIQs shall became the primary actor because he/she becomes responsible for the data collection, validation and use.
 - The CAIQ operator shall supervise the system and perform the risk analysis.
3. To organise the computing system toward a distributed data accessibility web-based system in order to allow the local CIQs to retrieve information useful for their activities.
 - A WebGIS computing technology allows the local authorities to interact with the system in order to retrieve data which are needed for the quarantine and export process.
 - Local authorities will be able to extract data from the designed web-based system in order to perform spatial analysis and reporting.
4. To adopt a well-defined framework for the risk analysis based on the spatial analysis technique in order to improve the results reliability.
5. To classify the POIs.
 - The classification of the POIs in a well-defined structure is essential for the appropriate management of the entire system.
 - A framework for the POI classification implies that the acquired dataset of POIs should be transformed in a schema that assigns a unique identifier to the feature.
 - The POI collection is a process that is activated when a candidate farm is under evaluation. Collected POIs shall be checked and validated by the local CIQs, in order to increase the reliability of data and therefore of the risk assessment. This process shall include the completion of the data set.
6. The feature/attribute shall be transposed in an enterprise environment.
7. The data security shall be introduced in the new framework.

3.1 Pilot Project

To verify the feasibility of the proposed functionalities a pilot test has been designed. The component of the pilot are (i) a WebGIS tool for the collection of the POI spatial/no-spatial information, (ii) a protocol for POI detection and the collection of relate data for the local CIQ operator, and (iii) a protocol for the spatial data analysis. At the moment of the paper submission, the pilot project has been partially developed in some quarantine station surrounding the city of Beijing.

For the pilot study a WebGIS, based on a previous Italian version of the software, has been installed in a server located in Beijing (in Fig. 6 a print screen of the client interface is presented).

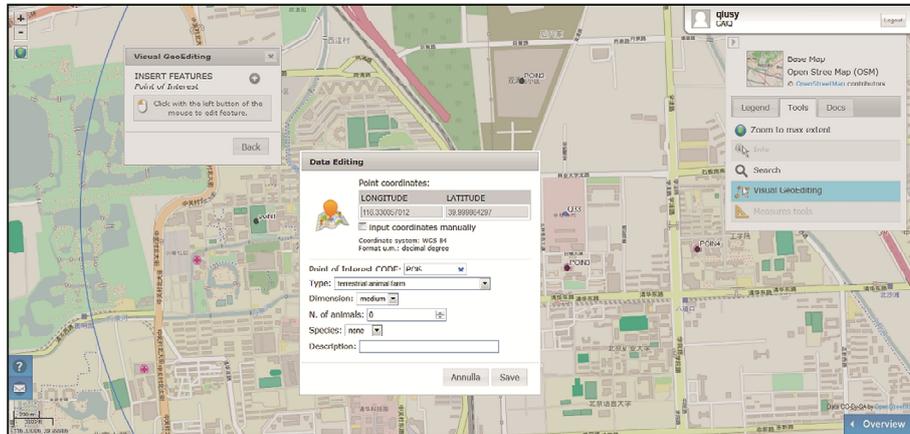


Fig. 6. Print screen of the webGIS tool – client interface

The architectural environment is based on three main components: Web server, Application server and Database server. All components has been installed in the single virtual machine developed in VMware. A suite of Open Source software has been used, in particular:

- The Operating System is Linux 12.04 LTS 64 bit version.
- Apache HTTP Server 2.2 has been installed as Web server and some specific libraries has been enabled, in order to run PHP applications.
- Apache Tomcat 7 has been installed as Application server in order to deploy and run Java applications.
- PostgreSQL version 9.1 has been installed as DBMS (database management system) with the spatial extension POSTGIS 2.0 that add, to the core software, all the functionalities that allow the management of spatial data.

Geo-spatial Server. The java-based application GeoServer 2.4.4 (based on the application server) has been installed in order to allow users to view and edit spatial data. A specific store, directly linked with the geodatabase, has been created and spatial data are published by OGC (Open Geospatial Consortium) standards Web Services (WS) that allow great flexibility in map creation and data sharing. In particular, Web Features Services (WFS) and Web Map Services (WMS) have been used.

WebGIS Application. The development process of the WebGIS application has been followed the same principles of standard web applications. Server side modules allow the database communication and page creation. This part has been developed using PHP 5.3. The client side has been developed using Javascripts (JS) code. Commons functionalities and components are ensured by JS Library (i.e. JQuery) and asynchronous communication with server side is allowed by Asynchronous JavaScript and XML (AJAX) technology. In order to manage spatial data derived by Spatial Services the OpenLayers 2.12 Spatial JS framework has been adopted.

Base Map. In a WebGIS specific services, offered by third-part companies, could be integrated in the application to create the base map layer. Base map layers are necessary to contextualise the position on the map. Currently, the only confirmed base map is OpenStreetMap (www.openstreetmap.org), showed through the portal using the RESTful API (Application programming interface) version 0.6 deployed 17–21 April 2009. Other base maps will be evaluated after the pilot exercise.

Functionalities. The typical GIS functionalities (i.e.: show/hide layers, Scale, Overview, Zoom management, layers interrogation, measurement) together with tailored functionalities (search position on the map, editing point features) are offered in this the application.

The protocol for POI identification and data collection is aimed: (i) to define the sequence of steps that a local CIQ should follow in order to identify POIs that surround the candidate quarantine station, and (ii) to collect the relevant data for each detected POI. Using the functionalities provided by the webGIS, the local CIQ will detect the POI by using both the visual target identification and the surface survey methods. The visual target identification method consist of the identification of any possible POIs in the buffer area by means of a geo-referenced image provided by the webGIS. Once the local CIQ will identify a facility that could represent a POI, he/she will plan the route to reach the identified location. The design of the route shall try to ride as much road that surrounds the candidate quarantine station as possible (unsystematic survey). Along the path, every time he/she will recognise a POI (POI that was not identified from the geo-referenced image) or if he/she will reach one of the targeted POI, he/she will stop the vehicle and will perform the identification of the POI and the related data collection. The data will be recorded in the system by means of the webGIS functionalities.

4 Conclusion

The present paper presents the preliminary results of a project dedicated to the development of a system for the management of spatial and non-spatial information related to the approval of quarantine stations. Once fully operative, the project, that can be considered the first example of a documented GIS application to support import-export veterinary inspection and quarantine activities, will allow:

- Better decision-making - This is associated either with carrying out the data analysis exercise (i.e. better accuracy in quarantine facility identification, risk analysis based on repeatable methodology).
- Improved communication - WebGIS-based maps and visualizations greatly assist in understanding the required analysis on quarantine station location. They can be seen as a new language that improves communication between CAIQ and local CIQ, but most of all, among trade partners.
- Promote the reuse of data - Many organizations that collect and manage data are not able to realize that data can be reused to produce new information. The idea to reuse the “transactional data” (data that support the daily operations of an organization, i.e. describes business events) as “analytical data” (data that support decision-making,

reporting, query, and analysis, i.e. describes business performance) can improve the ERP (Enterprise Resource Planning) capabilities of an organisation.

For CAIQ the proposed GIS development process is a novelty, going beyond the technical dimension of an easier and more efficient management of information. The introduction of a structured GIS-based framework will highlight exploitation areas beyond the narrow context of the existent division of responsibilities between different parts of organizations, as well as cooperation problems, data exchange and utilization. In this sense, it should be expected that an effective GIS introduction in the CAIQ activities would be a breakthrough in terms of functionality and decision-making, will re-deploy functional priorities and will lead to a revision of conventional approaches for the character and the efficiency of provided services. To achieve these results, a substantial background and skills, not only in “pure GIS discipline” but also in IT, spatial data analysis and project management are required.

The MoE project, developed within the activities of the OIE cooperation project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China” is a striking example of how the OIE aims to build the awareness of the scientific communities and improve compliance with its own standards. In fact one of the aims of the OIE it is to strengthen global disease surveillance networks and projects like Moe WebGIS (which promotes capacity building of an Institution) are crucial to foster technological innovation in the management of veterinary surveillance and controls. Moreover, this project highlights the benefits of development cooperation, in particular how the exchange of know - how between two Institutions could provide more opportunities for organizational learning and capacity building development, extending, at the same time, the OIE network of expertise to provide better global geographical coverage for priority diseases and improving the acquaintance of the assessment of disease risks associated with trade.

5 Credits

This project has been developed in the framework the OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”. Part of research activities were also co-funded by the Italian Ministry of Health.

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GeoVET - A GIS framework for evaluation of spatial factors that affect the quarantine station

Abstract

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A GIS framework to evaluate spatial factors that affect the selection of animal quarantine stations in China. ¹ Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD), Italy; ² Chinese Academy of Inspection and Quarantine, Beijing, China, ³ Shenzhen Entry-Exit Inspection and Quarantine Bureau, Shenzhen, China.

Background information. The General Administration of Quality Supervision, Inspection and Quarantine of the Popular Republic of China defined a set of requirements for the identification of import-export animal quarantine stations. To improve the framework to be used for the evaluation of the quarantine station performance a GIS based protocol has been defined.

Study objective. To develop a GIS-based protocol to support the evaluation of spatial factors that can affect the evaluation of animal quarantine station performance.

Materials and method.

The classical waterfall schema project approach has been adopted. For the framework validation, a pilot study has been implemented. The pilot consists of a webGIS tool (developed with open source technologies) and a data analysis protocol (based on Simple Additive Weighted method combined with the Analytical Hierarchical Process).

Results.

The present paper reports the sequence of steps and the GIS management techniques used to develop the required GIS framework. In particular (i) the Business Case document template, (ii) the combined Use case analysis, As-Is analysis, Requirement analysis, and Gap analysis documents, (iii) the description of the pilot configuration.

Conclusion.

The study outlines the GIS management strategies identified during the implementation process of a GIS based application in an organisation characterised by a low level of GIS maturity.

Acknowledgments.

The present study has been developed in the framework of the OIE Cooperation Project "Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China" (<http://gis.izsvenezie.it/cooperation/oie/izsve-caiq/index.php>).

Technical phases – milestones

1. Infrastructure setup

Setup of CAIQ infrastructure, network and servers systems configuration (IP address, connectivity ...) is complete:

- Hyper-V virtual machine
- Windows 10 enterprise
- Apache 2.2
- Tomcat 7

Public IP address: **<TO BE COMPLETED>**

2. Setup WebGIS EN version

- 1) Set up of server software: **OK**
 - a) Install and setup web server (Apache)
 - b) Install and setup application server (Tomcat)
 - c) Install and setup PostGreSQL and PostGIS
- 2) Import data in PostGreSQL database **OK**
 - a) Data with no-geography (core tables for WebGIS)
 - b) Data from layers (with geography) using QGIS tool (layers for the WebGIS)
- 3) Deploy and setup Geoserver: **OK**
 - a) Create a new data-store and link it to the PostGIS
 - b) Publish data from Geoserver as WFS/WMS
- 4) Update PHP and JS files of WebGIS and deploy in Apache **OK**
 - a) Update IP address in the files according with point 1)
 - b) Link data to WFS/WMS
 - c) Update addresses in the proxy.php files for the WFS
- 5) Test the system using firebug or apache logs **OK**
- 6) Create users for the WebGIS **OK**
- 7) Security operations: **OK**
 - a) Define users and password for each previous points

3. Setup Chinese WebGIS

- 1) Import data in PostGreSQL database in CHINESE VERSION **BEFORE 15th AUGUST**
 - a) Data with no-geography (core tables for WebGIS)
 - b) Data from layers (with geography) using QGIS tool (layers for the WebGIS)
- 2) Publish data from Geoserver as WFS/WMS **BEFORE 15th AUGUST**
- 3) Update PHP and JS files of WebGIS for the Chinese version **OK**

d.a. 2_c Technical phases – milestones

- 4) WebGIS Chinese version accessible from outside china by the Italian and Chinese team during cooperation training in Italy **BEFORE 15th SEPTEMBER**
- 5) Update Security **BEFORE 15th AUGUST**
- 6) Integration with risk analysis protocol **BEFORE 15th AUGUST**
 - a) Species during the editing will be acquired. It is necessary to modify DB and form to acquired dimension of the farm
 - b) Remove cpot
 - c) Adding element

4. Requirement Analysis for more functionalities

- 1) Analysis of interoperability between WebGIS and other systems (i.e.: Ji Fan software) **UPDATE ON SEPTEMBER**
- 2) Analysis for more information and functions (to be defined) **UPDATE ON SEPTEMBER**

A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

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Credits

This document has been produced in the framework the OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

Terminology

Quarantine station

An establishment under the control of the Veterinary Authority where animals are maintained in isolation with no direct or indirect contact with other animals, to ensure that there is no transmission of specified pathogen(s) outside the establishment while the animals are undergoing observation for a specified length of time and, if appropriate, testing and treatment [ref. OIE - Terrestrial Animal Health Code].

Candidate quarantine station

A farm that has submitted the request to become a quarantine station.

POI (Point Of Interest)

Facility that exposes or is exposed to a risk of infection or contamination due to the presence of an exporting farm or a quarantine station located nearby.

Impact

The effect that the presence of a POI in the study area produces in the evaluation process of the facility performance.

Total impact

The cumulative effect of the whole POI impacts in the study area.

WebGIS

A technology used to display and analyse spatial data on the Internet. It combines the advantages of both the Internet and GIS. It offers public a new means to access spatial information with no need of expensive GIS software.

Exporting farm

Farm organised to export its livestock production.

Candidate exporting farm

Farm that has submitted the request to become an exporting farm.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

1. Introduction

The CAIQ GIS office is in charge of the evaluation of the requests from the candidate quarantine station and candidate exporting farm. The evaluation encompasses several factors such as:

- physical or spatial factors that affect the status of biosecurity in a compartment;
- infrastructural elements;
- biosecurity issues.

At present, the analysis of physical or spatial factors is based on a process that exploits a desktop GIS software, a set of spatial data acquired by a private company (this set of data presents information on the spatial location of POI and, under certain circumstances, the type of activities), and a set of information collected by means of a survey performed by the GIS coordinator (this survey has been performed for a limited number of candidate quarantine station). The analysis of the available data is based on a visual spatial analysis.

To improve the reliability of the spatial analysis outcomes, a framework based on the adoption of a webGIS to collect data, a process for field data collection made by the local CIQs and a spatial analysis based on Multi Criteria Method are proposed.

Purpose of Document

Proposal for the implementation of a protocol for the analysis of the spatial factors that affect the status of biosecurity in a candidate quarantine station and a candidate exporting farm.

The proposal consists of a master plan that describes the possible implementation of the system once the whole elements are made available to users and administrators, and a protocol for the pilot study that should be used to test the feasibility of the protocol described in the master plan.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

2. Master Plan

The framework to perform the analysis of the spatial factors that affects the status of biosecurity in the candidate farm or candidate quarantine station (candidate facility) is based on the following elements:

1. webGIS tool for the collection of POI's spatial/no-spatial information;
2. protocol for POI detection and the collection of related data made by the local CIQ operator;
3. protocol for the spatial data analysis at central level;
4. Web portal for the publication of relevant information.

2.1 WebGIS tool

The webGIS tool will be used by the local CIQ to edit the relevant POI that surrounds the candidate facility. The webGIS will allow the collection of POI's coordinates by means of two methods:

1. Indirect. The indirect method consists on marking the place directly in the map. The local CIQ is able to recognise the POI facility/ies by looking at the map presented by the webGIS. He/she uses the webGIS mark tool to place a point in correspondence of the facility/ies.
2. Direct. The local CIQ records the coordinates by means of a GPS and then he/she edits the point in the webGIS at the duty station.

The webGIS will allow to edit the no-spatial data directed in the webGIS while the local CIQ performs the survey on-site (this option requires a mobile device). The webGIS can also allow to edit the collected information once the operator returns to his/her duty station.

This tool requires the availability of georeferenced background maps.

2.2 On-site POI detection and data collection protocol

A well defined protocol for the on-site data collection integrated with the webGIS tool will be developed.

The protocol aims (i) to define the sequence of steps that a local CIQ should follow in order to detect POIs that surround the candidate facility and (ii) to collect the relevant data for the detected POI.

The method for the detection combines the visual target detection method with the surface survey one. The visual target detection aims to detect possible POI by means of an image made available by the webGIS. Once the local CIQ has detected possible POI then he/she plans the route to reach the identified location. The design of the route should consider to cover as much as road surrounding the candidate facility as possible (unsystematic survey). Along the path, every time he/she recognises a POI (POI that was not possible to recognise from the aerial image or he/she reaches one of the targeted POI) he/she stops the vehicle and performs the identification of the POI and the related data collection.

This protocol requires the availability of route map and background maps.

2.3 Data analysis

The data collected by the local CIQ are stored in a centralised geodatabase. The CAIQ GIS experts use these data to perform the spatial data analysis. The spatial data analysis is based on two steps:

1. ESDA (exploratory spatial data analysis);
2. MCM (multi criteria method).

The ESDA analysis aims to identify the presence of critical POIs in the study area. Critical POIs are the POIs that, in case they are located nearby the candidate facility, lead to reject the request.

For the no-critical POIs a calculation based on the Multiple Criteria Methods (MCM) is made with a dedicated script developed in the GIS software. The result of the calculation will be a value that will be compared to a defined threshold. If the calculated value is above the define threshold the request is rejected, vice versa the request is accepted.

Two different threshold levels are defined, one for the evaluation of the candidate quarantine station and one for the exporting farm.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

2.4 WebPortal

A dedicated web portal will be developed to publish the relevant information related to the collected and analysed information. Different type of user profile will be defined.

3. Pilot Study

The pilot study aims to verify, and eventually rectify, the process for the analysis of the spatial factor that affects the status of biosecurity in a candidate facility.

The pilot study encompass the following elements:

- identification of the study areas;
- test of the on-site POI detection and data collection protocol;
- test of the pilot webGIS functionalities;
- test of the data analysis protocol.

3.1 Identification of the study area

For the identification of the study area, the following elements are required:

1. location of the candidate quarantine station;
2. the extent of the areas that surrounding the candidate station;
3. POIs considered for the spatial evaluation;
4. background maps (aerial images and road maps).

The CAIQ GIS operator is in charge to upload the location of the candidate facility into the webGIS and the polygon of the study area (ie. Buffer of 3Km and 10Km)¹.

The presentation of the study area to the local CIQ can be implemented in two way:

- a) presentation of the available information on the **pilot webGIS** and development of the spatial evaluation on an on-line condition.
- b) presentation of the available information on a **QGIS document** and development of the spatial evaluation on an off-line condition.

3.2 POI detection and data collection

This phase is based on the following elements:

- the location of the already available POIs;
- a form for the on-site data collection;
- a method to plan the unsystematic survey;
- a procedure to collect the coordinate and the POI information.

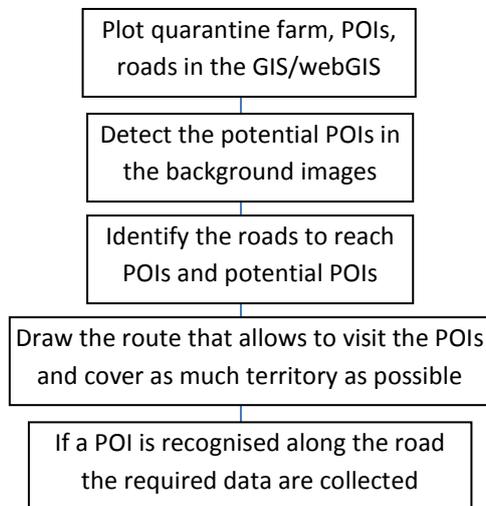
¹ The identification of the study areas is a cornerstone issue because it implies the decision/discussion about the following elements:

- which CRS. WGS 84, GCS-02, other?
- which background map. Tiles from the “Chinese version of Google Maps”, tiles from Bing, access to an image repository made available by a Chinese institution, create an image repository from the ESRI World Imagery basemap, other?
- any road map?

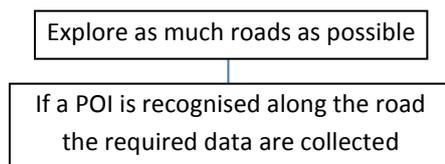
d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

The critical point in this phase is the method to plan the route. We can identify two possible solutions based on the presence or absence of a comprehensive² road map.

1. In case background maps and road maps are available, the proposed protocol is the following.



2. In case background maps and road maps are not available, the method is the following.



To collect the information related to the POI a paper form must be defined. The form should contain at least the following information (core data):

- POI location;
- POI code assigned by the user based on a well-defined format;
- type of POI (the value is derived from a code list);
- species breded;
- for POI farm, this value specifies the amount of animal breded;
- for POI different than a farm, this value specifies the dimension of the facility. The value is derived from a well defined code list;
- open text.

About the POI location, the information can be captured in two different ways:

1. with a GPS. In this case the local CIQ identifies a convenient location (ie.: the POI gate) and records the coordinates presented by the GPS in the paper form. Once he/she returns to the duty station he/she edits the POI location by means of the webGIS/GIS direct georeferencing tool.
2. the local CIQ, by navigating through the images provided by the webGIS/GIS detects the POI and, by means of the indirect georeferencing tool, edits the POI location.

Once the local CIQ once has edited the POI location, he/she adds the core data in the form made available by the webGIS/GIS.

² With the term “comprehensive” we refer to the qualitative characteristic of the map to represent, with a geographical coherence, as much road as possible.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

3.3 WebGIS function test

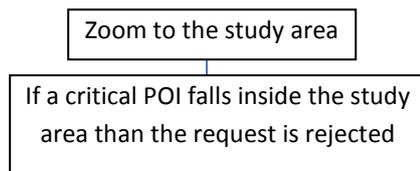
This phase is dedicated to test the pilot webGIS in the CAIQ server.

Once the pilot webGIS will be operative in a test configuration a list of webGIS functionalities will be tested by the CAIQ GIS expert and local CIQs.

3.4 Data analysis protocol

This phase is dedicated to a series of off-line operations made by the CAIQ GIS expert.

A GIS desktop software will be used to access the collected information. The GIS document will be organised according to a well defined set of layers that are portrayed according to a well defined thematic schema. This type of data organisation is oriented to allow the first explorative spatial analysis:



In case one or more no-critical POIs fall inside in the study area, the analysis of the spatial factors that affect the status of biosecurity in the candidate facility is stopped and a map, plus a message about the presence of critical point, is produced.

In case no critical points are within the study areas, the spatial analysis will be developed manually by means of a GIS software. It is clear that the sequence of steps can be embedded in the GIS software in order to create some automatic operation (i.e. a script in Python for QGIS or a schema in Model Builder for ArcGIS).

The spatial analysis consists of the following steps.

Preconditions

Three preconditions must be implemented before starting the analysis: (i) weight calculation, (ii) impact reclassification schema and (iii) threshold values.

Weight calculation

A weight represents the importance of a given type of POI with respect to the idea of accepting or rejecting the request of the candidate facility.

The proposed method for the weight calculation is based on a reduced version of the analytic hierarchy process (AHP) method. The AHP is a structured technique for organizing and analysing complex decisions, based on mathematics and psychology. The AHP exercise requires the participation of an expert that systematically evaluates the type of POIs by comparing them two at a time. The AHP converts these comparisons to numerical values for each POI. The result of the AHP exercise consists of a set of values (one for each type of POI) that represent the importance of each type of POI respect the other POIs.

The weights will be different for the two type of scenarios: the candidate quarantine station and the exporting farm.

The decision tool software will be used to perform the AHP analysis.

Impact reclassification schema

The observed POI characteristics have values that are not comparable among them. A reclassification is necessary. A reclassification schema, based on expert opinion elicitation, shall be performed. The reclassified value shall be used in the spatial analysis.

d.a. 2_d A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China

Threshold values

For each scenario a specific set of values shall be defined in order to evaluate whether or not to approve the request of the candidate facility: the threshold values.

To establish the threshold values a “scenario analysis” is adopted. For each of the two scenarios, a set of the already approved and rejected candidate facilities is selected. For these real case pictures, the total impact calculation is performed. The obtained values are organised in a discrete distribution from which extract the reject and approved threshold values.

For each scenario, two values will be derived: one value to approve the request (the lowest) and one value to reject the request (the highest).

Process

1st step: for each POI that fall inside the study area the intensity is calculated

2nd step: for each POI that fall inside the study area the impact value is calculated (intensity x weight)

3rd step: calculate the total impact of the surrounding POIs.

4th step: comparison of the summed value with the threshold value.

1st step – Intensity calculation

The information collected for each observed POI are used to derive their intensity. The intensity represents the size of the observed POI.

The intensity calculation of the observed POI is performed by a re-classification operation. In lay terms for each observed POI value the reclassification schema will be used to calculate the value intensity. For example, the observed value collected to express the “amount of animal housed in a farm” or the “dimension of the slaughterhouse” is transformed in a value that has a range from 1 to 5 according to the reclassification schema.

2nd step – impact calculation

The calculation of the weight times the intensity provides the impact of the observed POI. Clearly, the weight used in this calculation is compatible with the scenario under analysis.

Variations of the impact calculation can take into account the distance from the candidate feature and the presence of specific hot spots (calculate for instance the Getis ord G_i^*). These possible extensions are not presented in this document.

3rd step – Total impact

Since the values of the type of POI and intensity are dimensionless and have been calculated with the same range of magnitude, the values can be added together. This value represents the impact of the surrounding POIs. The value can be used to evaluate the “risk” associated to their presence with respect to the candidate facility.

4th step – Evaluation

The calculated total impact is compared with the threshold values in order to establish whether or not to accept the request submitted by the candidate facility.

ICCSA CONFERENCE

Presentation and pictures

GIS applications to support entry-exit inspection and quarantine activities

the framework of a strategy and the process for developing a spatial decision support systems for risk analysis of the quarantine station for animal import-export in China

The context

- Animal import/export
 - World Trade Organisation (WTO)
 - World Organization for Animal Health (OIE)
- Framework of the Agreement on the Application of Sanitary and Phytosanitary (SPS)
 - free trade
 - protection of human and animal health



The spatial domain

China

- Export
 - More than 300 farms located in 20 provinces
 - Principal destinations
 - Hong Kong
 - Macao
 - Trade volume each year: \$ 580 million
- Import
 - Principal providers
 - Australia
 - Canada



Problem statement

- Assess risks associated with trade in animals and their products
 - Protecting public health
 - Protecting animal health
 - Avoid trade bans
- Release assessment

description of the biological pathway(s) necessary for an imported commodity to 're-release' pathogenic agents into a particular environment



Problem statement

- Animal quarantine station
 - establishment under the control of the veterinary authority where animals are maintained in isolation with no direct or indirect contact with other animals*
 - Adequate separation of housed animals from the surrounding environment
 - [..]
 - Managerial
 - **Location**
 - Biosecurity
 - [..]



Problem statement

How a spatial decision support system can assist with the evaluation of a candidate animal quarantine station performance?

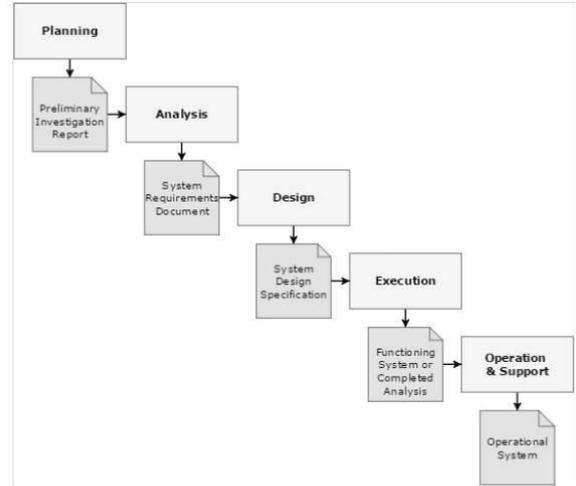
- Spatial nature
- Complex multi-dimensional and heterogeneous data
- Multiple participants with different and often conflicting interests
- Multiple categories of knowledge involved



Method

Constraints:

- GIS maturity
- Engage stakeholders
- Design complexity
- Inventory condition



The Analysis step

- Improve the level of informatisation
- Improve the geodata quality and management
- Integrate the location information in the risk analysis evaluation



The Design step

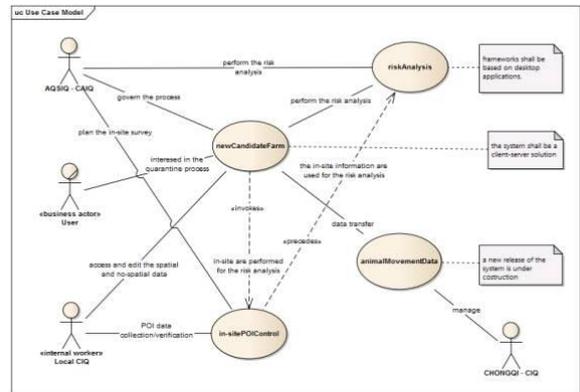
- New protocol for geodata collection.
- WebGIS for data editing and presentation.
- New protocol for data analysis.



The Design step - Protocol for geodata collection

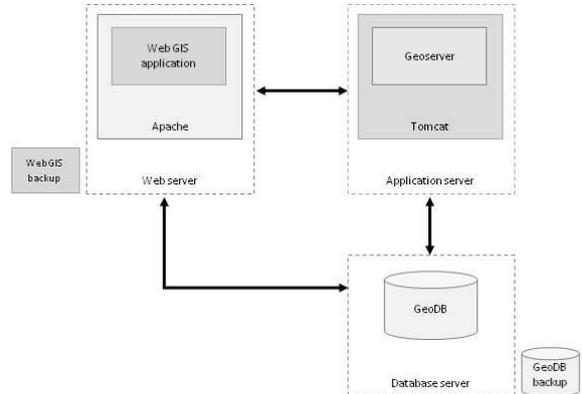
Decentralisation

data capture should be performed on a specific survey plan, and based on a well defined framework that shall include a tailored training session for the local CIQ



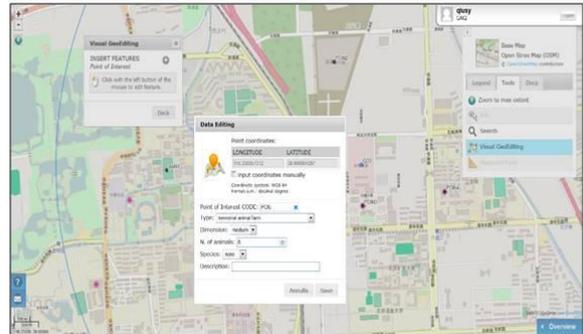
The Design step – webGIS for data editing and presentation

- Linux 12.04 LTS 64 bit
- Apache HTTP Server 2.2
- Apache Tomcat 7
- PostgreSQL version 9.1 + POSTGIS 2.0
- Geoserver 2.4



The Design step – webGIS for data editing and presentation

- Server side: PHP 5
- Client side: Javascripts code
+ JS Libraries (i.e. JQuery)
+ OpenLayers 2.12



The Design step – risk analysis

To evaluate the impact in the **premises** exposed to the risk of animal introduction in the area

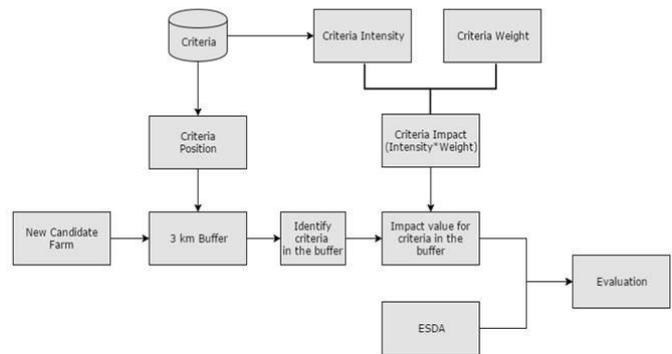


Simple Additive Weighting Method

To evaluate **physical** or **spatial factors** that affect the performance of the quarantine station



Exploratory Spatial Data Analysis

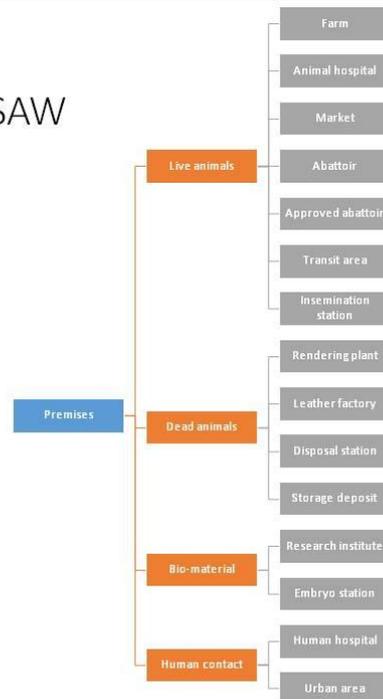


The Design step – risk analysis - SAW

$$Total\ Impact = \sum w_i x_i \times \prod c_j$$

Criteria

premises that directly or indirectly can be exposed to a disease problem derived from the presence of animals in the quarantine station (e.g.: flocks, herds, abattoir)



The Design step – risk analysis - SAW

$$Total\ Impact = \sum w_i x_i \times \prod c_j$$

x_i = is the **intensity** of the observed i Criteria
the intensity is a quantifiable measure and represents the dimension of the criteria.

Example of intensity:

- Farm= number of housed animals
- Abattoir= number of slaughtered anim.

The values are re-classified



The Design step – risk analysis - SAW

$$Total\ Impact = \sum w_i x_i \times \prod c_j$$

w_i = is the **weight** for the i Criteria type

c_j = Boolean constraint.

*It takes into account the “critical criteria”.
 The critical criteria are the class of criteria that shall not be near a quarantine station*

The screenshot shows the SAW software interface with a user profile 'mmazzucato' and a 'Log out' button. The main heading is 'Importance of the premises that directly or indirectly can be exposed to a disease problem derived from the presence of animals in the quarantine station.' Below this is a 'Comparisons' section with a prompt: 'Please complete the following comparisons.' There are four rows of sliders, each representing a comparison between two criteria types. The sliders are labeled with 'absolutely more important', 'moderately more important', 'same importance', 'moderately more important', and 'absolutely more important'. The 'same importance' slider is currently selected for all four comparisons: Live Animals vs Dead animals, Live Animals vs Bio Materials, Live Animals vs Human contacts, and Dead Animals vs Bio Materials.

RApache + R scripts

The Design step – risk analysis - ESDA

- Field survey
 - Natural barriers
 - Artificial barriers
 - Wild animals sites

Land cover data (?)

Base map layers (?)



Conclusion

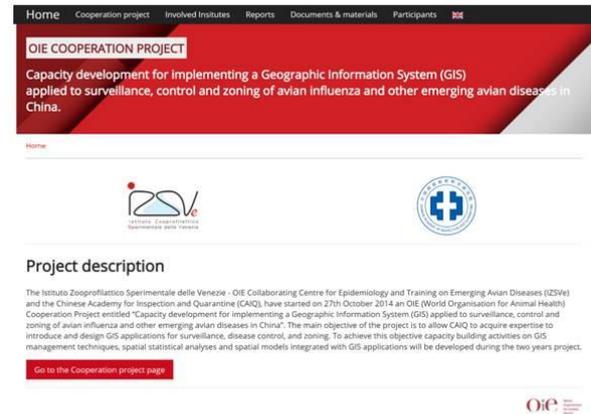
- First example of a documented SDSS for import-export veterinary inspection and quarantine activities
- Better decision-making
- Improved communication



Credits

OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”

- Istituto Zooprofilattico Sperimentale delle Venezie
- Chinese Academy for Inspection and Quarantine



Thankyou for your attention

GIS applications to support entry-exit inspection and quarantine activities



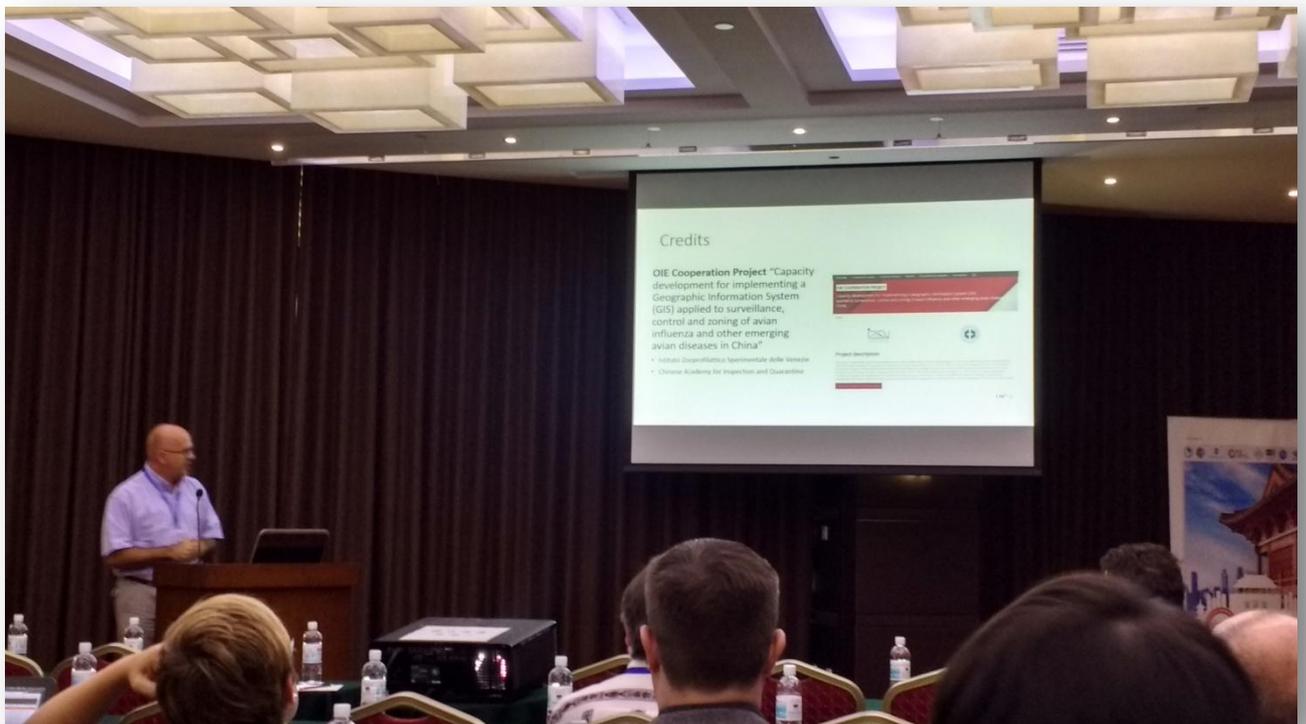
Nicola Ferrè¹, Qiu Songyin², Matteo Mazzucato¹, Andrea Ponzoni¹, Paolo Mu-latti¹, Matteo Morini¹, Ji Fan³, Liu Xiaofei², Dou Shulong², Lin Xiangmei², and Stefano Marangon¹

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² Chinese Academy of Inspection and Quarantine, Beijing - China

³ Shenzhen Entry-Exit Inspection and Quarantine Bureau, Shenzhen - China

Pictures



Executive summary – Summer 2016

Defined during the 5th mission (02-08/07/2016)

1. WebGIS development

Activity	Deadline date
Import data in PostGreSQL database in CHINESE VERSION a) Data with no-geography (core tables for WebGIS) b) Data from layers (with geography) using QGIS tool (layers for the WebGIS)	15 th August
Publish data from Geoserver as WFS/WMS	15 th August
Update PHP and JS files of WebGIS for the Chinese version	22 nd August
WebGIS Chinese version accessible from outside of China, by the Italian and Chinese team during training in Italy	15 th September
Update Security on Server, Database, Geoserver	15 th August
Integration with risk analysis protocol a) Species will be acquired during the editing. It is necessary to modify <u>Database</u> and <u>form</u> to acquired dimension of the farm b) Remove cpot field c) Update of type filed dictionary	

Before the end of the year, the product will be completed.

2. Requirement Analysis for more functionalities

Activity	Period
Analysis of interoperability between WebGIS and other systems (i.e.: Ji Fan software)	6 th Meeting
Analysis for more information and functions	6 th Meeting

3. Cooperation project

1. Planning the Chinese GIS training in China. This training will be between March/April 2017.
 - Mr Fan and Mr Qiu will manage the first training
 - Mr Fan will manage the following training to the Local CAIQ
2. Planning the training at IZSve for 3 Chinese scientists for one week (from the 19th to 27th of September 2016)
 - 2 WebGIS developer
 - 1 Analysis model developer
3. Zoning
 - Definition of GIS schema during the March/April training period
4. Metadata Catalogue
 - Installation of the GeoNetwork Metadata Catalog on the CAIQ Server.
 - Definition of the list of metadata to be published
 - Definition and creation of the metadata
5. Final workshop
 - Proposed Period: October 2017
 - Proposed Location: New CAIQ building in Beijing
 - To be defined asap:
 - i. Organization committee
 - ii. Goal/Purpose
 - iii. Invited participant
 - iv. Speakers

Spatial decision support systems for risk analysis of the Exporting Farms in China

Authors: Nicola Ferrè¹, Qiu Songyin²

¹ Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD), Italy

² Chinese Academy of Inspection and Quarantine, Beijing, China

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Credits

This document has been produced in the framework of the OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”.

Relate documents

This document derives from the elaboration of the following documents:

- GIS applications to support entry-exit inspection and quarantine activities
Authors: Nicola Ferrè, Qiu Songyin, Matteo Mazzucato, Andrea Ponzoni, Paolo Mulatti, Matteo Morini, Ji Fan, Liu Xiaofei, Dou Shulong, Lin Xiangmei and Stefano Marangon
- Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China.
Authors: Nicola Ferrè and Qiu Songyin

Terminology

Quarantine station

An establishment under the control of the Veterinary Authority where animals are maintained in isolation with no direct or indirect contact with other animals, to ensure that there is no transmission of specified pathogen(s) outside the establishment while the animals are undergoing observation for a specified length of time and, if appropriate, testing and treatment [ref. OIE - Terrestrial Animal Health Code].

Exporting farm

Farm organised to export its livestock production.

Candidate quarantine station

Farm that has submitted the request to become a quarantine station.

Candidate exporting farm

Farm that has submitted the request to become an exporting farm.

POI (Point Of Interest)

Facility that exposes or is exposed to a risk of infection or contamination due to the presence of an exporting farm or a quarantine station located nearby.

Impact

The effect that the presence of a POI in the study area produces in the evaluation process of the facility performance.

Total impact

The cumulative effect of the whole POI impacts in the study area.

WebGIS

A technology used to display and analyse spatial data on the Internet. It combines the advantages of both the Internet and GIS. It offers public a new means to access spatial information with no need of expensive GIS software.

Reference

Decree of the General Administration of Quality Supervision, Inspection and Quarantine of People's Republic of China No. 122 "Administrative Measures for the Supervision on the Use of the Quarantine Station of Entry animals" dated October 22nd, 2009.

Source: Framework for the evaluation of the spatial factors that influence the candidate quarantine station performances in China.

Introduction

Geographic information systems (GIS) can provide tools and analytical solutions to support activities related to the inspection of entry-exit animals and animal products. For example, with a GIS it is possible to depict the spatial distribution of the quarantine station with respect to the entry point (ie.g.: port, airport etc.), or to evaluate the land use composition surrounding a quarantine station or exporting farm, and so on.

The AQSIQ has introduced the systematic application of the spatial evaluation to assess the requests about the candidate quarantine station and the candidate-exporting farm (candidate facility). The spatial evaluation essentially consists of a visual analysis of the POIs surrounding (within a radius of 3Km) the candidate facility.

To improve the reliability of the spatial analysis outcomes, a spatial decision support system based on the adoption of a webGIS to collect data, a process for field data collection made by the local CIQs and an explorative spatial analysis have been proposed. The explorative spatial analysis is based on a Multi Criteria Method. The proposed method requires some detailed theoretical and technical descriptions in order to allow an easy implementation by the CAIQ personnel.

Purpose of Document

The aim of this document is to describe the relevant elements required to perform the explorative spatial analysis to support the risk analysis associated to the evaluation of a candidate facility.

In particular, the document describes:

- spatial evaluation process;
- AHP method;
- ri-classification method;
- threshold calculation method.

Spatial evaluation process

The spatial evaluation process is based on the following three elements:

1. Pre-requisites

The pre-requisites consist of a series of conditions that are necessary to be already in place before starting the spatial evaluation process. These pre-requisites are:

- a webGIS able to collect the information about the POI from the local CIQ;
- a set of weights associated to the type of POIs;
- a diagram to re-classify the observed POI's characteristics;
- a set of values used as threshold during the output analysis.

2. Analysis development

The analysis consists of the calculation of a so called "total impact".

The total impact can be considered as a numerical value that represents the riskiness at which the candidate facility is exposed due to the presence of the surrounding POIs.

To calculate the "total impact" the Simple Additive Weighted (SAW) method is used. The SAW method consists essentially in adding-up the contribution of every single POI surrounding the candidate facility. POI's contribution consists of a value calculated as the product between the

weight assigned to that specific type of POI, times the dimension of the observed POI. For example if the surrounding POI are 2 farms and 1 abattoir the SAW calculus is:

$$\begin{array}{|c|} \hline \text{Farm 1 dimension} \\ \hline \text{X} \\ \hline \text{Farm weight} \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Farm 2 dimension} \\ \hline \text{X} \\ \hline \text{Farm weight} \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Abattoir 1 dimension} \\ \hline \text{X} \\ \hline \text{Abattoir weight} \\ \hline \end{array} = \text{Total Impact}$$

To obtain POI's weight the Analytical Hierarchy Process (AHP) is used.

To obtain POI's dimension the data collected by the local CIQ will be re-classified according to a well defined diagram.

3. Outcome evaluation

The outcome evaluation consists of the comparison of the obtained total impact value with the threshold values, the production of a map that presents the location of the candidate facility with the 3Km buffer and the surrounding POIs and finally a map that represents the location of the candidate facility with the 10Km buffer and, eventually, the protected site areas that are included or nearby the buffer.

Spatial analysis

The spatial analysis protocol consists of a sequence of steps presented in figure 2. As already mentioned, the protocol is based on the SAW method. The SAW method is based on the concept of a weighted average in which continuous criteria are standardized to a common numeric range and then combined by means of

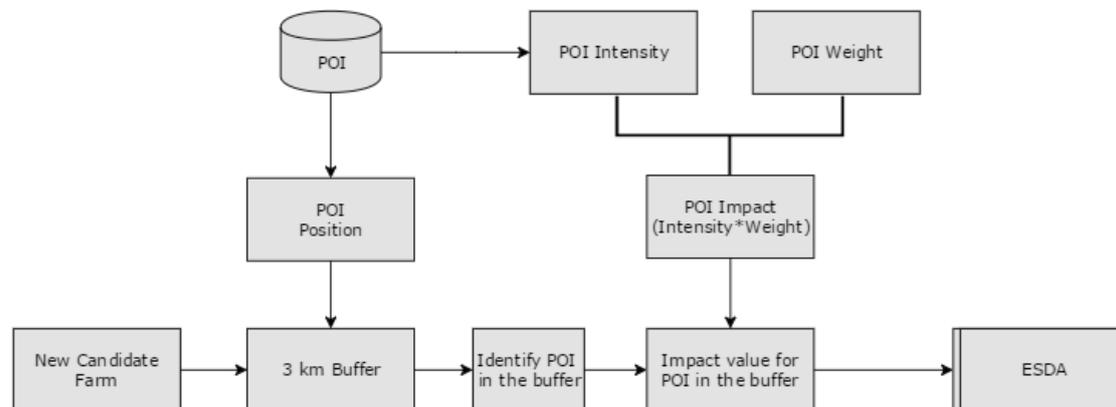


Figure 1. SAW process

a weighted average in order to obtain a score. In our context:

- the criteria are represented by a set of features called Point of Interest (POI). The POIs are premises that directly or indirectly can be exposed to a disease problem derived from the presence of animals in the quarantine station. The list of POIs includes: (i) flocks or herds, (ii) animal hospitals, (iii) animal markets, (iv) slaughterhouses, (v) veterinary research institutes, (vi) rendering plants, (vii) fur and leather plants, (viii) artificial insemination stations, (ix) embryo transfer stations, (x) bio-safety disposal stations, (xi) human hospitals, (xii) border posts, and (xiii) animal storage depots;
- the score, called "Total Impact", is obtained by multiplying the importance weight assigned to each POI class with the classified value of the observed POI and then summing the products over the POIs that fall inside the study area (area of 3Km radius surrounding the candidate facility).

$$Total\ Impact = \sum w_i x_i s_i \times \prod c_j$$

Where:

Total Impact = is the impact associated to the POI distribution in the area that surrounds the candidate facility.

w = is the weight for the *i* type of POI

x = is the intensity of the observed *i* POI. The intensity is a quantifiable measure and represents the dimension of the POI. For example, the intensity for the “farm” class of POI is its size (number of animals), for a hospital the number of beds, etc. The values are re-classified according to a re-classification diagram.

s = is a value that is placed equal to 1 if the POI houses a species that can be exposed, at least, to one disease that can infect the introduced animals, and 0 if the POI houses a species that cannot be exposed, at least, to one disease that can infect the introduced animals.

c = Boolean constraint. Take into account the “critical POIs”. The critical POIs are the class of POIs that shall not be near a quarantine station. The presence of a critical POI in the area surrounding the candidate quarantine station leads directly to reject the request to become a quarantine station.

Outcome evaluation

The Total Impact is compared with a defined threshold value. If the impact is above the threshold, the request to become a new quarantine station will be rejected. The threshold value is defined by means of a scenario analysis.

The spatial evaluation process is completed by the following outputs:

1. map of the candidate facility with the surrounding land use and a buffer of 10 Km;
2. map of the candidate facility with a buffer of 3 Km and all the POIs evaluated;
3. a short report with the SAW outcome and a brief evaluation of the total impact calculated included the comparison with the threshold value.

Pre-requisites

Data collection

The spatial evaluation process is based on data collected through the webGIS by the local CIQ.

The webGIS manual provides instruction to:

1. Add a POI farm
 - a. Visually identify a farm facility;
 - b. Add the farm location with a point;
 - c. Select the value “farm” as the type of POI ;
 - d. Select the dimension of the farm according to a well defined classification.
2. Add POIs that are not farms:
 - a. Input the geographical coordinates collected with a GPS;
 - b. Select the correspondent type of POI;
 - c. Select the dimension value based on a well defined classification.

Re-classification

The information about POI's dimension is collected by the local CIQ and stored in the webGIS database. The information "dimension" describes how big is the observed POI. Since the evaluation process combines different types of POIs, we need to express the dimension information as a dimensionless value. In lay terms, if among the observed POIs there is a farm that is breeding 300 chickens and an animal hospital that is able to take care of 300 animals each day, the two observed values are the same (300) but clearly a farm of 300 chickens can be considered a small farm, while an hospital that nursing 300 animals each day is quite a large facility. Therefore, if we consider only the number 300 we can overestimate or underestimate the "effect" of POI's dimension in the evaluation process.

A possible solution to avoid the problem of misusing the dimension value, it is transforming the observed values according to a re-classification diagram. With a re-classification a value is transformed into a new range of values; the new value becomes dimensionless and it can be compared with other types of information.

A typical re-classification values is based on the small, medium and large significance (where small has value 1, medium 2, and large 3).

The re-classification diagram assigns the re-classified value for each observed value. For instance, for a chicken farm a possible re-classification diagram can be: "if the number of animal is from 1 to 1000, the farm can be considered small, from 1001 to 10000 medium and above 10001 large." Following the example, the observed farm of 300 chickens can be re-classified as "small" and the animal hospital "large". The two pieces of information now are comparable.

To define a re-classification diagram for the type of POIs an expert opinion exercise should be performed. The expert opinion exercise could be a Delphi method where the moderator has the goal to reach a consensus over the range of value to classify the various type of POIs.

The AHP method

AHP is the acronym of "Analytical Hierarchy Process". The AHP belongs to the expert elicitation class of analysis. The AHP is used to derive the relative importance (weight) of a set of well defined criteria. In this context, the AHP method is used to derive the type of POI's weight. The outcome of the AHP exercise is a value between 0 and 1 for each type of POI. The sum of value is equal to 1.

To perform an AHP exercise the software Expert Choice is used.

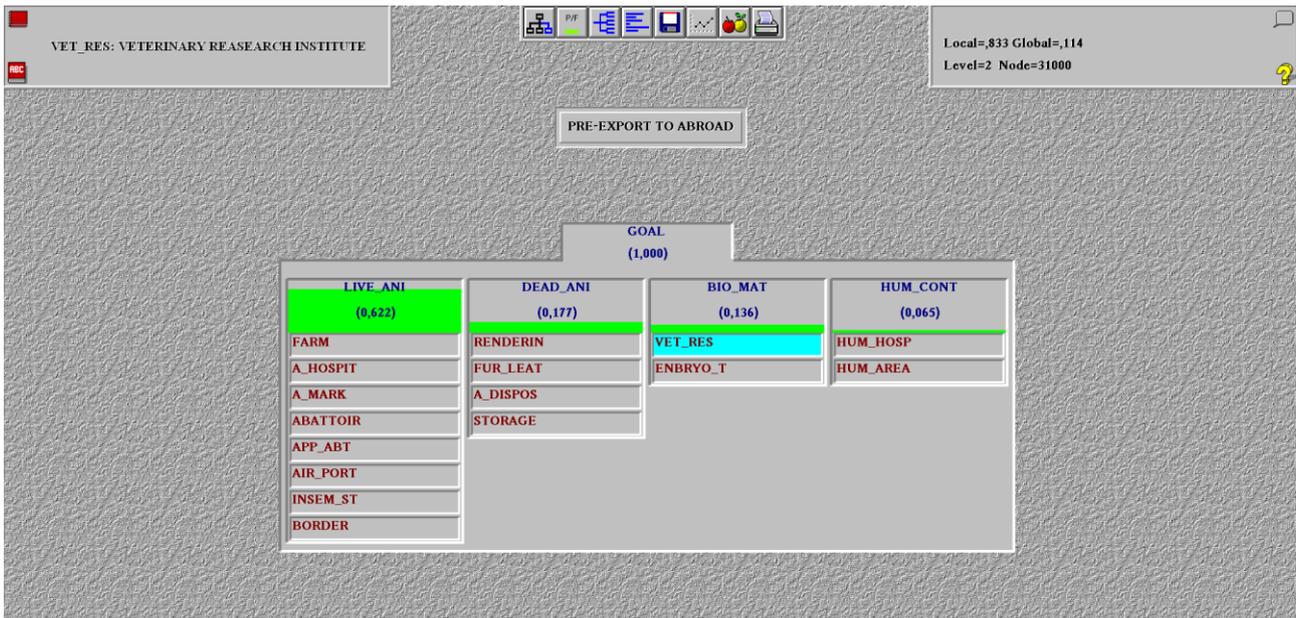


Figure 2. Expert choice print screen

To perform an AHP exercise, a panel of expert and a moderator to conduct the exercise are needed. The moderator interviews each expert (the interviews can be performed in separate sessions) and asking the relative importance of a type of POI respect to another type of POI. The pairwise comparison is performed for all possible POI's combination. The result of the AHP exercise for an expert is a list of weights and a level of consistency, if the level of consistency is above a given threshold, the exercise shall be repeated. Once all the experts of the panel have been interviewed, for each type of POI's value the average value is calculated.

<p>Expert 1</p> <p>Type of POI1 weight: 0,3</p> <p>Type of POI2 weight: 0,2</p> <p>Type of POI3 weight: 0,4</p> <p>Type of POI4 weight: 0,1</p> <p style="text-align: right;">Sum: 1</p>	<p>Expert 2</p> <p>Type of POI1 weight: 0,4</p> <p>Type of POI2 weight: 0,2</p> <p>Type of POI3 weight: 0,3</p> <p>Type of POI4 weight: 0,1</p> <p style="text-align: right;">Sum: 1</p>	<p>Expert 2</p> <p>Type of POI1 weight: 0,3</p> <p>Type of POI2 weight: 0,3</p> <p>Type of POI3 weight: 0,3</p> <p>Type of POI4 weight: 0,1</p> <p style="text-align: right;">Sum: 1</p>	<p>Result</p> <p>Type of POI1 weight: 0,3</p> <p>Type of POI2 weight: 0,2</p> <p>Type of POI3 weight: 0,3</p> <p>Type of POI4 weight: 0,1</p> <p style="text-align: right;">Sum: 1</p>
--	--	--	---

The threshold values

The output of the evaluation process is a numeric value. To assign a significance to this value, it is necessary to compare it with a scale of values. In particular the comparison shall be between the calculated value and a threshold value. The threshold value represents the limit above which the request should be rejected from the spatial point of view.

The threshold value can be obtained by simulation. In lay terms 12/15 spatial visual analysis already performed should be selected. Between 80% and 85% of the analysis should refer to "Approve" outcome and the remain to "Reject". The proposed spatial evaluation method should be applied for this use case and the total impact values organised in terms of distribution as the example below.

use case	total impact value	outcome
1	6,5	Approved
2	5,3	Approved
3	3,2	Approved
4	9,3	Rejected
5	4,3	Approved
6	6,4	Approved
7	7,5	Rejected
8	4,1	Approved
9	5,1	Approved
10	6,3	Approved
11	4,3	Approved
12	7,1	Rejected
13	6,9	Approved

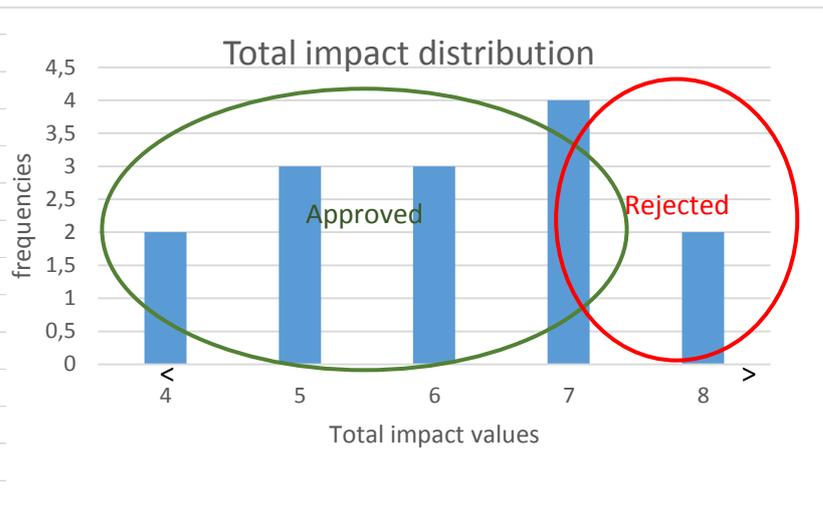


Figure 3 Example of threshold value calculation. Total impact distribution

In the example presented above, the threshold value could be “7”. It is clear that the total impact values that are close to 7 need to be carefully evaluated before assigning the “Approved/Reject” evaluation.

OIE Cooperation Project
Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China

1. Activity 2.5 Training of two Candidate Institute scientists on GIS management at the IZSVe Parent Institute

2. Activity 2.6 Training of one CAIQ scientists on GIS analysis at the IZSVe Parent Institute

3. Activity 2.7 Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSVe Parent Institute

TRAINING AGENDA

DEPARTURE: Beijing airport – 18/09/2016

ARRIVAL: Venice airport – 18/09/2016

DAY 1 Monday 19/09

Morning Discussion about the cooperation project development

DAY 2 Tuesday 20/09

Morning WebGIS status analysis and discussion

Afternoon WebGIS development

Risk analysis implementation analysis and discussion

DAY 3 Wednesday 21/09

Morning WebGIS development (continue)

Risk analysis implementation (continue)

Afternoon WebGIS development (continue)

Zoning discussion on planning the “Editing a conceptual model for developing Zoning areas in China”, analysis and discussion

DAY 4 Thursday 22/09

Morning WebGIS development (continue)

Metadata and metadata catalogue, analysis and discussion

Afternoon WebGIS development (continue)

Zoning discussion on planning the “Editing a conceptual model for developing Zoning areas in China” task (continue)

DAY 5 Friday 23/09

Morning WebGIS development (continue)

ESDA techniques, analysis and discussion

Afternoon Wrap-up and organisation of the next project activities

DAY 6 Monday 26/09

Morning WebGIS development (continue)

Afternoon WebGIS development (continue)

DAY 7 Tuesday 27/07

Morning WebGIS development (continue)

DEPARTURE: Venice airport – 28/09/2016

ARRIVAL: Beijing airport – 29/09/2016

MINUTES

- Training of two Candidate Institute scientists on GIS management at the IZSVe Parent Institute
- Training of one CAIQ scientists on GIS analysis at the IZSVe Parent Institute
- Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSVe Parent Institute

Venue

Location: IZSVe headquarter, Legnaro (PD), Italy

Participants

CAIQ	IZSve
QIU SONGYIN - VETERINARIAN	NICOLA FERRÈ – GIS MANAGER
TANG TIANYU - ENGINEER	MATTEO MAZZUCATO – GIS TECHNICIAN
YE MIN - ENGINEER	ANDREA PONZONI – IT MANAGER
	MONICA LORENZETTO - STATISTICIAN
	ANNIE ISHEBABI – PROJET OFFICER

Introduction

With the training of 3 CAIQ scientists on GIS management, GIS analysis and Zoning at the IZSve the cooperation project started the training phase dedicated to improve the GIS maturity of the candidate laboratory. This is the crucial phase of the project because the whole GIS essential elements presented and discussed in the previous activities will be “put in practice” in order to allow CAIQ’s experts to develop a GIS project in a coherent and structured way in their home country.

During the workshop held in May 2015 in Guangdong (CHN), it emerged the need for CAIQ scientists to develop a WebGIS application to support the collection of spatial information of the facilities of interest. Following this request, some modifications of the project were submitted to the OIE with the first annual report (First Annual report_Annex 5 Project Changes. pdf). The requested changes were aimed to transpose the theoretical aspects of GIS management and spatial analysis into the idea of developing a system that includes a WebGIS application and spatial framework for data capture and spatial analysis. In particular, respect to the original planned activities, Activity 2.5 “Training of two Candidate Institute scientists on GIS management at the IZSve Parent Institute”, Activity 2.6 “Training of one CAIQ scientist on GIS analysis at the IZSve Parent Institute”, and Activity 2.7 “Training of three (two plus one) Candidate Institute scientists on Zoning at the IZSve Parent Institute”, during the training program more emphasis was put on the practical example of “Setting up a webGIS” with respect to the theoretical aspects presented during the “advanced GIS and ESDA” and “Introductory GIS components” activities.

To include the practical aspects in the training activities most of the times it was planned to solve technical issues and tuning the software scripts. Once it was not necessary the presence of Mr Qiu Songyin and Mr Nicola Ferre’ in the webGIS developing tasks, the two scientists spent their time to discuss about the theoretical aspects on the Zoning and GIS spatial analysis (Mrs Monica Lorenzetto was also present during this meeting). The two other CAIQ scientists (Mr Tang Tianyu and Mrs Ye Min) were supported in their

Annex 4 - Training on GIS management, analysis and zoning definition and management

activity of webGIS development by the IZSve experts (Mr Matteo Mazzucato and Mr Andrea Ponzoni) and Prof Massimo Rumor.

Day 1 - Monday 19th September 2016 – Introductory meeting

Topics:

- introductory meeting
- revision and approval of the 5th meeting minutes
- administrative issues

Participants

CAIQ	IZSve
QIU SONGYIN - VETERINARIAN	NICOLA FERRÈ – GIS MANAGER
TANG TIANYU - ENGINEER	MATTEO MAZZUCATO – GIS TECHNICIAN
YE MIN - ENGINEER	ANDREA PONZONI – IT MANAGER
	MONICA LORENZETTO - STATISTICIAN
	ANNIE ISHEBABI – PROJET OFFICER

Minutes

Mr Ferrè presented the training program describing the last adjustments on the agenda. Mr Ferrè informed the Chinese colleagues that the training program was tailored to resolve the technological problem of webGIS and metadata catalogue. For this reason, and according to the project plan, Prof. Rumor supported the Chinese and Italian scientists in the webGIS and metadata catalogue implementation. The program was approved by the participants.

Mr Ferrè presented the 5th meeting minutes. The discussion was about the unsuccessful attempt made by Mr Ferrè and Mr Mazzucato to get in touch with experts or scientists involved on mapping program in China.

Mr Songyin introduced the webGIS implementation status. The technical problems related to the server installation and the internet connectivity encountered during the previous mission were solved and a stable Beta version of the webGIS was ready to be analysed and tested by the Italian experts.

Mr Ferrè introduced the issues of the “Activity 2.8 Editing a conceptual model for developing Zoning areas in China” and the idea of developing a preliminary document to describe the essential elements of the proposed conceptual model. Mr Songyin informed that the theoretical aspect developed during the project activities can be transposed in a practical application for an area located in the North of Beijing where a process for a Zoning definition is actually in progress. Mr Songyin proposed to develop a more formal document about the spatial component of an area defined following the OIE Zoning procedure to submit to the Chinese functionaries that are working on this matter. Mr Ferrè considered this opportunity a good chance to test the hypothesis developed during the project activities. Mr Ferrè proposed also to extend the evaluation of the conceptual model for developing Zoning areas to the theoretical aspects and this is the for this reason why he proposed to organise a meeting in China where the project experts, the Chinese functionaries that are working on the Zoning area implementation and an expert in Zoning could discuss about the proposed model. Mr Ferrè proposed to contact Dr Gardner Murray that has already worked in China for the Zoning area implementation for the 2008 Beijing Olympics Equestrian Events (G. Murray,

2009. The development of disease-free zones for equine diseases – including the example of China, Conf. OIE 2009, 125-130). Mr Songyin proposed to organise a meeting in May/June 2017. A request to organise the proposed meeting under the project umbrella will be submitted to OIE headquarter for approval. The meeting ended at 13:00. The rest of the day, the Chinese team was occupied with some administrative issues (e.g.: medical visit, cash collection from the bank desk).

From day 2 to day 4 (20th – 22nd of September 2016)

Topics:

Training of the two plus one CAIQ scientists on:

- WebGIS development
- Metadata catalogue implementation
- Explorative Spatial Data Analysis (ESDA) for Zoning

Participants

CAIQ	IZSVe
QIU SONGYIN - VETERINARIAN	NICOLA FERRÈ – GIS MANAGER
TANG TIANYU - ENGINEER	MATTEO MAZZUCATO – GIS TECHNICIAN
YE MIN - ENGINEER	ANDREA PONZONI – IT MANAGER
	MONICA LORENZETTO - STATISTICIAN
	MASSIMO RUMOR – IT EXPERT

Minutes

The training activities were organised in the following way:

- Morning session: theoretical aspects on a specific training subject.
- Afternoon session: CAIQ scientists developed the assigned activities supported by IZSVe experts.

The first part of the training focused on the analysis and solution of the webGIS technological bugs. WebGIS worked properly, but some problems related to the firewall/proxy connection from Italy to China were identified. According to the IT security policies, some special rules on the firewall were implemented and a remote desktop connection with the Chinese server was established. In order to evaluate the WebGIS final user usability a quick analysis on the layers style was performed. According to this analysis, a set of the styles was defined to describe all information with an appropriate symbology. The management of the layers style was splitted in two components: one managed on the GeoServer based on the SLD rules, one the client side using OpenLayers engine. The first component, according to the SLD standards, publishes spatial data with a specific style attached through Web Map Services (WMS), the second one receives vector data through Web Feature Services and dynamically attached the style on the WebGIS client. Using this method published data can be exposed with their own style. The creation of the rules and SLD required few hours and, at the end, some tests on the WebGIS were performed.

When all the data and the web services ran properly, GeoServer authentication modules for services were enabled in order to improve the security. Specific users were defined and according with the GeoServer policy, all Web Services (WS) exposed were protected by username and password. In order to allow the

Annex 4 - Training on GIS management, analysis and zoning definition and management

WebGIS to interact with WSS, a specific proxy in PHP language was developed. The proxy encoded all requests from the WebGIS and redirected them to GeoServer including the authentication.

The next phases were dedicated to the installation and tuning of the Geonetwork Opensource software used to publish the metadata catalogue service of the available spatial information.

The last version of the GeoNetwork (3.0.4) was downloaded from the official repository and it was installed on the CAIQ Server. After the deployment, a dedicated database in PostGRES SQL was created in order to store all the GeoNetwork data. Direct link with GeoServer data was not created, because the metadata catalogue will be used only for the “discovery action”. A software link on the WebGIS application will be created to connect the Metadata Catalogue.

About the ESDA task, Italian and Chinese experts worked together to draft the “Framework for the evaluation of the spatial factors that influence the candidate quarantine station performances in China” (see d.a. 4_a “Framework for the evaluation of the spatial factors”). These documents aimed to provide a framework dedicated to the evaluation of the spatial factors that influence the candidate quarantine station’s performances.

Day 5 - Friday 23rd of September 2016

Topics:

Training of the two plus one CAIQ scientists on:

- WebGIS development
- Metadata catalogue implementation
- Meeting wrap-up

Participants

CAIQ	IZSve
QIU SONGYIN – VETERINARIAN	NICOLA FERRÈ – GIS MANAGER
TANG TIANYU – ENGINEER	MATTEO MAZZUCATO – GIS TECHNICIAN
YE MIN – ENGINEER	ANDREA PONZONI – IT MANAGER
	MONICA LORENZETTO - STATISTICIAN
	MASSIMO RUMOR – IT EXPERT

Minutes

Morning

The training activities of Mr Tianyu and Mrs Min together with Prof Rumor, Mr Ponzoni and Mr Mazzucato were dedicated on webGIS and metadata catalogue development, while Mr Songyin, Mr Ferrè and Mrs Lorenzetto worked on the ESDA framework.

Afternoon

Wrap-up meeting.

The discussion was opened by Mr Mazzucato who described the problems encountered in the implementation of the two technological tool in development. In particular, Mr Mazzucato presented the

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ones linked to Chinese language. Specific bug for the Chinese Charset conversion was presented in the Search functionality due to the Unicode codification. To bypass the problem an English version of the metadata was created and some “test metadata” were published.

Mr Ferrè and Mr Songyin presented the “Executive summary” document (see d.a. 4_b “Executive summary”). The document was discussed and approved. Two topics were in particular discussed:

1. Training of all relevant CAIQ staff – GIS and webGIS application (Activity 2.9).

The training will be held between March/April 2017. Precondition to perform the course will be:

- webGIS for field test released;
- webGIS user manual, edited;
- framework for the evaluation of the spatial factors that influence the candidate quarantine station and exporting farm performances in China, approved;

The course will be in Chinese language and Italian experts will be involved only to supervise the server functionalities.

2. Course on GIS applications to support entry-exit inspection and quarantine activities (spin-off).

The request to organise the spin-off GIS course to OIE will be sent by the two Institutes before in the first part of 2017. The course:

- will be jointly organised by CAIQ and IZSVe.
- will be held in China, in English language.
- the proposed timeframe is May/June 2017
- will be focused on the basic usage of GIS for veterinary activities and in particular to support entry-exit inspection and quarantine activities.

Days 6 and 7 - (26th – 27th of September 2016)

Topics:

Training of the two plus one CAIQ scientists on:

- WebGIS development
- Metadata catalogue implementation

Participants

CAIQ	IZSVe
QIU SONGYIN - VETERINARIAN	MATTEO MAZZUCATO – GIS TECHNICIAN
TANG TIANYU - ENGINEER	ANDREA PONZONI – IT MANAGER
YE MIN – ENGINEER	MASSIMO RUMOR – IT EXPERT

Minutes

The training activities continued in order to resolve the issues linked to the WebGIS development and Metadata catalogue implementation.

At the end of the training period, the following results were achieved:

- Bug checking of the WebGIS functionalities;

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- WebGIS layers style definition according with the CAIQ definition;
- GeoServer security improvement;
- WebGIS proxy development;
- GeoNetwork installation and setting to store data in PostGresSQL;
- Metadata tests publication;
- Validation of the Analysis process for new Exporting Farm.

LIST OF DOCUMENTS ATTACHED (d.a.)

Related to activity 2.4. Coaching of the Candidate Institute GIS laboratory organization

- d.a. 4_a Framework for the evaluation of the spatial factors
- d.a. 4_b Executive summary

Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China

Authors: Nicola Ferrè¹, Qiu Songyin²

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² Chinese Academy of Inspection and Quarantine, Beijing, China

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Credits

This document has been produced in the framework of the OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”.

d.a. 4_a Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China

Related documents

The present document originates from the elaboration of the following documents:

- GIS applications to support entry-exit inspection and quarantine activities
Authors: Nicola Ferrè, Qiu Songyin, Matteo Mazzucato, Andrea Ponzoni, Paolo Mulatti, Matteo Morini, Ji Fan, Liu Xiaofei, Dou Shulong, Lin Xiangmei and Stefano Marangon
- A pilot study to evaluate the spatial factors that affect the status of biosecurity in quarantine station and exporting farm in China
Authors: Nicola Ferrè and Qiu Songyin

Terminology

Candidate facility

A farm or a quarantine station that has submitted the request to become an exporting farm or a quarantine station.

Constraint

A factor that includes or excludes the related POI impact in the calculus of the total impact.

Impact

The effect that the presence of a POI in the study area produces in the evaluation process of the Candidate facility performance.

Performance

The capability of a Candidate facility of reducing or even eliminating the threat of introducing diseases in an area.

POI (Point Of Interest)

Facility that exposes or is exposed to a risk of infection or contamination due to the presence of a Candidate facility located nearby.

Quarantine station

An establishment under the control of the Veterinary Authority where animals are maintained in isolation with no direct or indirect contact with other animals, to ensure that there is no transmission of specified pathogen(s) outside the establishment while the animals are undergoing observation for a specified length of time and, if appropriate, testing and treatment [ref. OIE - Terrestrial Animal Health Code].

Total impact

The cumulative effect of the whole POI impacts in the study area.

WebGIS

A technology that is used to display and analyse spatial data on the Internet. It combines the advantages of both the Internet and GIS. It offers public a new means to access spatial information with no need of expensive GIS software.

d.a. 4_a Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China

1. Introduction

The CAIQ GIS office is in charge of the evaluation of the requests about the candidate facility. The candidate facility evaluation encompasses several factors such as:

- physical or spatial factors that affect the status of biosecurity in a compartment;
- infrastructural elements;
- biosecurity issues.

At present, the analysis of physical or spatial factors is based on a process that exploits a desktop GIS software, a set of spatial data acquired by a private company (this set of data presents information on the spatial location of POI and, under certain circumstances, the type of activities), and a set of information collected by means of a survey performed by the GIS coordinator (this survey has been performed for a limited number of candidate facility). The analysis of the available data is based on a visual spatial analysis. To improve the reliability of the spatial analysis outcomes, a framework based on the adoption of a webGIS to collect data, a process for field data collection made by the local CIQs and a spatial analysis based on Multi Criteria Method are proposed.

1.1 Purpose of Document

Proposal of a framework dedicated to the evaluation of the spatial factors that influence the candidate facility performances.

The proposal consists of a master plan that describes the constitutive elements to perform the risk analysis related to the spatial factors that influence the performances of the candidate facility.

2. Master Plan

The framework for the evaluation of the spatial factors that influences candidate facility's performances is based on the following elements:

1. webGIS tool for the collection of the candidate facility or POI's spatial/non-spatial information;
2. protocol for the editing of the candidate facility spatial information made by the local CIQ operator;
3. protocol for POI detection and the collection of related data made by the local CIQ operator;
4. protocol for the analysis to evaluate the spatial factors that influence the candidate facility's performances and the Exporting Farm risk evaluation.

2.1 WebGIS tool

The webGIS tool is used by the local CIQ to edit the spatial information and the related relevant characteristics of:

- 1) candidate quarantine farms;
- 2) POIs that surround the candidate facility and Exporting Farm.

The webGIS allows the collection of the coordinates by means of two methods:

1. Indirect. The indirect method consists of marking the place directly in the map. The local CIQ by looking at the map presented by the webGIS is able to recognise the candidate facility, or POI facility/ies. He/she uses the webGIS mark tool to place a point in correspondence of the facility/ies.
2. Direct. The local CIQ records the coordinates of the candidate facility, or POI facility/ies by means of a GPS and then he/she edits the point in the webGIS at the duty station.

The webGIS allows to edit the non-spatial data related to the candidate facility, or POI in the webGIS while he/she performs the survey on-site (this option requires a mobile device). The webGIS allows also to edit the collected information once the operator returns to his/her duty station.

The list, the meaning and characteristics of non-spatial data related to the candidate facility, or POI are illustrate in the "webGIS user manual".

d.a. 4_a Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China

2.2 Candidate facility data collection

A well defined protocol for the candidate facility data collection integrated with the webGIS tool is illustrated in the “webGIS user manual”.

The protocol has the purpose:

1. to define the sequence of steps that a local CIQ should follow in order to georeference the candidate facility;
2. to collect the required non-spatial data;
3. to inform the CAIQ GIS expert of the new request.

2.3 POI data collection

A well defined protocol for the POI on-site data collection integrated with the webGIS tool, is illustrated in the “webGIS user manual”.

The aims of the protocol are:

1. to define the sequence of steps that a local CIQ should follow in order to detect POIs surrounding the candidate facility;
2. to collect the relevant data for the detected POI.

The method for the detection combined the visual target detection method with the surface survey one. The visual target detection aims to detect possible POIs by means of an image made available by the webGIS. Once the local CIQ has detected a possible POI, he/she plans the route to reach the identified location. The design of the route should consider to cover as much as road surrounding the candidate facility as possible (unsystematic survey). Along the path, every time he/she recognises a POI (POI that was not possible to recognise from the aerial image or he/she reaches one of the targeted POI) he/she stops the vehicle and performs the identification of the POI and the related data collection.

This protocol requires the availability of route map and background maps in the webGIS tool.

2.4 Spatial Data analysis

The data collected by the local CIQ are stored in a centralised geodatabase. The CAIQ GIS experts use these data to perform the spatial data analysis. The spatial data analysis consists of three elements:

1. protocol to perform the explorative spatial data analysis.
This phase aims to perform the preliminary evaluation about the presence of POI on orographic elements that have an high impact on the evaluation of the candidate facility performance according to the defined standards;
2. protocol to arrange the collected data and to perform the total impact calculation for the Exporting Farm. The main outcome of this protocol is the calculation of the total impact value;
3. protocol to embed the spatial analysis outcome in the risk analysis.

2.4.1 Protocol to perform the explorative spatial data analysis for the candidate facility

The purpose of the Explorative Spatial Data Analysis (ESDA) is to identify the presence of critical POIs in the study area and the major orographic elements that can influence the candidate facility performance within the 10 Km radius.

The presence of the critical POIs are determined by a sequence of GIS functions. The presence of any critical POIs nearby the candidate facility leads to reject the request.

The presence of orographic elements that can have an influence on the candidate facility (i.e.: river, lakes, major road, mountains, etc.) are detected from the spatial ancillary data that are uploaded in the GIS project. Specific ESDA (Exploratory Spatial Data Analysis) will be defined once the spatial ancillary will be identified and integrated in the process.

d.a. 4_a Framework for the evaluation of the spatial factors that influence the quarantine station and exporting farm performances in China

2.4.2 Protocol to arrange the collected data and to perform the total impact calculation for the Exporting Farm

The data collected by the local CIQ about the POIs are used to calculate the cumulative influence of the POIs on candidate facility performance. The data must be extracted and stored in a dedicated excel file by using a well defined sequence of GIS functionalities.

The impacts of the POIs in the area surrounding the candidate Exporting Farm are calculated by means of a series of operation that are already uploaded in the excel file. The sequence of operation is based on the SAW (Simple Additive Weighted) method that is described in the “Spatial decision support systems for risk analysis of the Exporting Farm” (Annex 3 - Spatial decision support systems for risk analysis of the Exporting Farms in China).

The result of this phase is the calculation of the total impact value for the candidate Exporting Farm.

2.4.3 Protocol to embed the spatial analysis outcome in the risk analysis

This final step of the framework aims to organise the documents produced during the previous phases and to provide a report organised with the following elements:

1. Set of maps of the candidate facility area;
2. Brief description of the orographic elements with a specific judgment about the possible influence of elements that can influence the candidate Exporting Farm performance;
3. In case of the presence of critical POIs in the study area, brief description of the detected POIs and evaluation of that presence with respect to the distance from the candidate Exporting Farm;
4. Brief report that describes the outcome of the Total impact value with an evaluation of the obtained value with respect to the “accept/reject scale value”.

Executive summary

End of November 2016

- 1) WebGIS release for field test
- 2) May-June workshop: definition of the topics
- 3) Submission to OIE of the program of the GIS course in China
- 4) First draft 2nd year report release to OIE
- 5) First draft “Spatial concept model Zoning” submitted to Mr Dou for his revision and subsequent involvement of Dr G. Murray in the revision process.
- 6) First agenda meeting Mr Dou, Mr Marangon and Dr G. Murray.

End of February 2017

- 1) WebGIS field test accomplished
- 2) WebGIS user manual edited
- 3) Approval of the May-June workshop contents
- 4) Definition of the agenda for the meeting Mr Dou, Mr Marangon and Dr G. Murray March-April 2017
- 1) Short Term mission of Mr Ferré, Mr Mazzucato, Mr Ponzoni, Mrs Ishebabi.
Objectives:
 - Audit and simulation exercise [Activity 3.2]
 - Editing a conceptual model and coaching in developing a webGIS application [activity 2.8]
- 2) Course in Chinese on webGIS [Activity 2.3]?

May-June 2017

- 1) GIS course in China
- 2) Workshop IZSve-CAIQ/AQSIQ
- 3) Meeting

July 2017

- 1) Action plan for introducing the GI based OIE compliant zoning strategy [Activity 3.5]
- 2) Final assessment of GIS laboratory [Activity 3.3]

October-November 2017

Final workshop

Proposal for the development of a spatial data model based on the OIE Zoning procedure

DOCUMENT INFORMATION

Title:	Proposal for the development of a spatial data model based on the OIE Zoning procedure
Creator:	Nicola Ferrè, Qiu Songyin
Subject:	Spatial data specification.
Description:	This document describes a study proposal for the development of a spatial data specification model for zones defined according to the Zoning procedure as described in chapter 4.3 of the Terrestrial Code (OIE – Terrestrial Animal Health Code, 2014)
Publisher:	<ul style="list-style-type: none">• Istituto Zooprofilattico Sperimentale delle Venezie (Italy)• Chinese Academy of Inspection and Quarantine (China)
Date:	21/09/2016
Identifier:	Zoning conceptual model
Language:	En
Relation:	OIE – Terrestrial Animal Health Code, 2014

Credits

This document has been produced in the framework of the OIE Cooperation Project “Capacity development for implementing a Geographic Information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China”.

Terminology

Data capture. Process to collect geographic information. The process includes: (i) establishing data requirements, (ii) setting up of appropriate GIS hardware and software systems to edit and store the geographical data, (iii) editing or obtaining the data, possible redrafting poor-quality data sources, and removing noise, and (iv) data validation, error correction and quality improvement.

Data quality. Degree to which a set inherent characteristics fulfils requirements. In other words, completeness of attributes in order to achieve the given task.

Data product specification. Detailed description of a dataset together with additional information that will enable it to be created, supplied to and used by another party.

Geographic information. Information concerning phenomena implicitly or explicitly associated with a location relative to the Earth.

Metadata. Data about data. In other words, Metadata describes how and when and by whom a particular set of data was collected, and how the data is formatted.

Portrayal. Presentation of information to humans

Rationale

According to the OIE Terrestrial Code, Zoning or regionalisation is a procedure implemented by an OIE Member Country under the provisions of the relevant chapters of the Terrestrial Code in order to define subpopulations, on a geographical basis, of distinct health status within its territory for the purpose of disease control and/or international trade (Article 4.3.1).

Zones defined according to the Zoning procedure contain a subpopulation with a distinct health status within its territory. The subpopulation may be separated by natural or artificial geographical barriers or, in certain situations, by the application of appropriate management practices (Article 4.3.1).

Spatial considerations (together with good management and biosecurity plans) play an important role in the application of the Zoning concept. In particular, the extent of a zone and its geographical limits should be established by the Veterinary Authority on the basis of natural, artificial and/or legal boundaries, and made public through official channels (Article 4.3.3).

The OIE Terrestrial Code provides neither specifications nor instructions on how to represent the geographical limits of a zone defined according to OIE's Zoning procedure, nor methods or services to share and transfer such information in digital/electronic form to the OIE and other relevant stakeholders.

In geomatics words, what the OIE Terrestrial Code does not provide is the *data product specification* of the geographical representation of a zone, defined according to the OIE Zoning process. According to ISO 19131:2007 Geographic Information – Data Product Specification¹, a “data product specification is a detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to and used by another party. It is a precise technical description of the data product in terms of the requirements that it will or may fulfil. It forms the basis for producing or acquiring data. It may also help potential users to evaluate the data product to determine its fitness for use by them.”. In lay terms, with a data specification for a geographical information, the following elements are clearly described:

1. data content and structure (e.g. application schema, feature catalogue);
2. reference system;
3. data quality;
4. data capture;
5. data maintenance;
6. technologies and framework for data product delivery;
7. metadata needs.

Implementing the geographical representation of zones defined according to the OIE Zoning process by means of a data product model, will:

- enhance the understanding and usage of geographic information;
- promote availability, access, integration, and sharing of geographic information;
- promote transparency, consensus and methodological coherence of geographic information;
- promote the efficient and effective use of digital geographic information and associated software systems.

¹ This International Standard describes requirements for the specification of geographic data products, based upon the concepts of other ISO 19100 International Standards. It describes the content and structure of a data product specification. It also provides help in the creation of data product specifications, so that they are easily understood and fit for their intended purpose.

Objective

Propose a data product specification for the spatial information of zones defined according to the OIE Zoning process, in order to enable the Veterinary Authority to create and use it for the description of the zone extent.

Zone - essential elements

Zones are established according to the following elements:

- In accordance with specific legislative requirements;
- For the purpose of one or more diseases control and/or for international trade;
- A Veterinary Authority defines a specific action plan (within such plans, measures such as permit, promote, prohibit, restrict, etc. are defined);
- The action plan applied over:
 - a specific zone;
 - a specific animal subpopulation;
 - a continuous time periods or only within specific schedules time slots.

Moreover, a zone can be:

- subjected to various restrictions, or regulations, or management regimes at the same time;
- related to other zones.

Finally, the zone geographical boundary must not necessarily correspond to administrative limits, but it can also take into account natural borders (e.g.: rivers, lakes), artifacts (e.g. fences), and infrastructures (e.g. road, railroad).

Zone data content – main characteristics

Based on the assumption made in the “Zone - essential elements” paragraph, it is possible to draw a first hypothesis of relevant Zone data content characteristics.

1. Zone specific properties

Information about the essential spatial information for describing the zone:

- Geometry (representing the spatial extent of the spatial object. This shall be either a GM_Surface or GM_MultiSurface);
- Time period when a zone was legally designated or became effective;
- Relation to other zones.

2. Type / subtype of zones

This information specifies the reason why the zone has been established:

- Type (e.g.: containment, protection);
- Diseases (for this information a multilingual registry should be considered)

3. Identification and maintenance properties

Information about the zone identification:

- Id (there should be more than one code but one must be chosen as unique identifier);
- Geographical name (for this information a geographical reference should be associated).

4. Competent authority

Information about the competent authority responsible for delivering, regulating and monitoring the zone:

- Authority (name, address, web site, etc.);
- Contact person (name, address, email, etc.).

5. Reference to legal basis

Reference to the legislative document that establishes the zone:

- Legal reference.

6. Controlled activities

Information describing the type of activity (i.e.: vaccination, monitoring) that is implemented within the zone. For this information, a set of multilingual registry should be considered:

- Type of measure;
- Time period;
- Animal subpopulation.

Conclusion

Data Specification is an important cornerstone of any data sharing framework. With a Data Specification document, the veterinary scientific community can ensure a coordinated approach regarding harmonisation of the zones defined according to the OIE Zoning process's data and services in matters of content, resolution and quality.

When adopted by Member States, Data Specification of the zones defined according to the OIE Zoning process will form the base for the definition of user-oriented cross-border and world wide data services and products. Moreover, conformance to the Data Specification of the zones defined according to the OIE Zoning process will ensure the aggregation of data in a more cost effective and efficient way.

The Data Specification of the zones defined according to the OIE Zoning process will be edited according to the ISO standard ISO 19131:2007 Geographic Information – Data Product Specification.

Annex 6 - Strategic Objective title: Capacity development for implementing a Geographic information System (GIS) applied to surveillance, control and zoning of avian influenza and other emerging avian diseases in China

FINANCIAL REPORT

Financial report for (month/year) to (month/year)	27/10/2014-15/12/2016		
Parent Reference Laboratory Collaborating Centre:	Collaborating Centre for Epidemiology, Training and Control of Emerging Avian Diseases at Istituto Zooprofilattico Sperimentale delle Venezie		
Candidate Laboratory Centre:	Chinese Academy of Inspection and Quarantine (CAIQ)		
Animal disease(s) or topic covered:	GIS, Avian influenza and other emerging avian diseases, epidemiology		
Project dates (day/month/year) - (day/month/year):	27/10/2014-27/10/2017		
Final budget approved:	€ 132.380,00		
Currency:	euro		
Revised budget			
Currency:			

EXPENDITURE	Amount budgeted	Amount spent to date	Comments/Description
Travel - Laboratory visits (from Parent to Candidate lab and from Candidate to Parent Lab)			
Total travel costs - Laboratory visits: Expert 1 (Matteo Morini)	€ 3.900,00	€ 948,80	Matteo Morini Beijing 22-28/11/2014 (M1 111807/2014)
Total per diem - Laboratory visits: Expert 1 (Matteo Morini)	€ 3.177,11	€ 767,06	Matteo Morini Beijing 22-28/11/2014 - 6 nights Beijing and Dubai (M1 111807/2014)
Total travel costs (Annie Ishebabi)		€ 715,20	Annie Ishebabi Beijing 18-26/03/2016 (M1 121280/2016)
Total per diem (Annie Ishebabi)		€ 1.411,50	Annie Ishebabi Beijing 18-26/03/2016 - 7 nights (M1 121280/2016)
Sub-total	€ 7.077,11	€ 3.842,56	
Total travel costs - Laboratory visits: Expert 2 (Nicola Ferrè)	€ 9.100,00	€ 948,80	Nicola Ferre' Beijing 22-28/11/2014 (M1 111789/2014)
		€ 576,12	Nicola Ferre' Canton 10-18/05/2015 (M1 115438/2015)
		€ 715,20	Nicola Ferre' Beijing 18-26/03/2016 (M1 121162/2016)
		€ 1.041,89	Nicola Ferre' Beijing 01-09/07/2016 (M1 124091/2016)
		€ 716,94	Nicola Ferre' Beijing 22-28/11/2014 - 6 nights Beijing and Dubai (M1 111789/2014)
Total per diem - Laboratory visits: Expert 2 (Nicola Ferrè)	€ 8.260,49	€ 1.095,98	Nicola Ferre' Canton 10-18/05/2015 - 6 nights (M1 115438/2015)
		€ 1.433,84	Nicola Ferre' Beijing 18-26/03/2016 - 7 nights (M1 121162/2016)
		€ 1.622,13	Nicola Ferre' Beijing 01-09/07/2016 - 7 nights (M1 124091/2016)
Sub-total	€ 17.360,49	€ 8.150,90	
Total travel costs - Laboratory visits: Expert 3 (Matteo Mazzucato)	€ 7.800,00	€ 577,71	Matteo Mazzucato Guangzhou (China) 10-15/05/2015 (M1 115261/2015)
		€ 715,00	Matteo Mazzucato Beijing 18-26/03/2016 (M1 121181/2016)
		€ 1.041,89	Matteo Mazzucato Beijing 01-09/07/2016 (M1 124094/2016)
		€ 962,62	Matteo Mazzucato Guangzhou (China) 10-15/05/2015 - 6 nights (M1 115261/2015)
Total per diem - Laboratory visits: Expert 3 (Matteo Mazzucato)	€ 6.513,08	€ 1.407,97	Matteo Mazzucato Beijing 18-26/03/2016 - 7 nights (M1 121181/2016)
		€ 1.434,34	Matteo Mazzucato Beijing 01-09/07/2016 7 nights (M1 124094/2016)
Sub-total	€ 14.313,08	€ 6.139,53	
Total travel costs - Laboratory visits: Expert 4 (Paolo Mulatti)	€ 9.100,00	€ 948,80	Paolo Mulatti Beijing 22-28/11/2014 (M1 111817/2014)
		€ 577,71	Paolo Mulatti Guangzhou (China) 10-15/05/2015 (M1 115262/2015)
		€ 150,00	Paolo Mulatti Beijing 18/03/2016 - cancelled flight (M1 121164/2016)
		€ 694,66	Paolo Mulatti Beijing 22-28/11/2014 - 6 nights Beijing and Dubai (M1 111817/2014)
Total per diem - Laboratory visits: Expert 4 (Paolo Mulatti)	€ 8.260,49	€ 929,67	Paolo Mulatti Guangzhou (China) 10-15/05/2015 - 6 nights (M1 115262/2015)
		€ 133,79	Paolo Mulatti Beijing 18/03/2016 - cancelled visit (M1 121164/2016)
Sub-total	€ 17.360,49	€ 3.434,63	
Total travel costs - Laboratory visits: Expert 5 (Stefano Marangon)	€ 2.600,00		
Total per diem - Laboratory visits: Expert 5 (Stefano Marangon)	€ 1.588,56		
Sub-total	€ 4.188,56		
Total travel costs - Laboratory visits: Expert 6 (Andrea Ponzoni)	€ 6.500,00	€ 715,18	Andrea Ponzoni Beijing 18-26/03/2016 (M1 121163/2016)
Total per diem - Laboratory visits: Expert 6 (Andrea Ponzoni)	€ 5.718,80	€ 1.466,02	Andrea Ponzoni Beijing 18-26/03/2016 - 7 nights (M1 121163/2016)
Sub-total	€ 12.218,80	€ 2.181,20	
Total travel costs - Laboratory visits: Expert (Trainees)	€ 10.400,00	€ 895,89	Ord. 4380/2015 Qiu Songyn flight tickets for training at IZS VE Legnaro (PD) from 18/10/15 to 31/10/15
		€ 895,89	Ord. 4380/2015 Ji Fan flight tickets for training at IZS VE Legnaro (PD) from 18/10/15 to 31/10/15
		€ 797,80	Ord. 3626/2016 Tang Tianyu flight tickets for training at IZS VE Legnaro (PD) from 18/09/16 to 28/09/16
		€ 797,80	Ord. 3626/2016 Qiu Songyn flight tickets for training at IZS VE Legnaro (PD) from 18/09/16 to 28/09/16
		€ 797,80	Ord. 3626/2016 Ye Min flight tickets for training at IZS VE Legnaro (PD) from 18/09/16 to 28/09/16
Total travel costs (within China)- Laboratory visits: Expert (Trainees)	€ 750,00		
		€ 1.085,14	Qiu Songyn per diem from 18/10/15 to 31/10/15 at IZS VE Legnaro (PD) Ord. 4825/2015, Payment order 1019/15 dated 14/10/15
		€ 1.085,14	Ji Fan per diem from 18/10/15 to 31/10/15 at IZS VE Legnaro (PD) Ord. 4826/2015, Payment order 1019/15 dated 14/10/15
		€ 460,00	Qiu Songyn overnight stay at Bed & Breakfast Al Ponte from 18/10/15 to 30/10/15, Ord. 4904/2015 Receipt nr. 265 dated 14/11/15
		€ 460,00	Ji Fan overnight stay at Bed & Breakfast Al Ponte from 18/10/15 to 30/10/15, Ord. 4904/2015 Receipt nr. 265 dated 14/11/15
		€ 116,00	Qiu Songyn and Ji Fan transfer Ord. 4857/15 Air service Padova Invoice nr. 00073 dated 31/10/15, Payment order 20 dated 13/01/16
		€ 180,00	Ord. 5286/2015 Dinner at Zairo Filimbeni Srl, Invoice nr. 5 dated 30/10/15, Payment order 1238 dated 09/12/15
Total per diem - Laboratory visits: Expert (Trainees)	€ 16.679,84	€ 775,10	Tang Tianyu per diem from 18/09/16 to 28/09/16 at IZS VE Legnaro (PD) Ord. 4050/2016, Payment order 818 dated 14/09/16
		€ 775,10	Qiu Songyn per diem from 18/09/16 to 28/09/16 at IZS VE Legnaro (PD) Ord. 4051/2016, Payment order 818 dated 14/09/16
		€ 775,10	Ye Min per diem from 18/09/16 to 28/09/16 at IZS VE Legnaro (PD) Ord. 4052/2016, Payment order 818 dated 14/09/16
		€ 599,54	Tang Tianyu overnight stay at Liviana Srl from 18/09/16 to 28/09/16, Ord. 3541/2016, Invoice nr. 34 dated 30/09/16, Payment order 1079 dated 25/11/16
		€ 599,54	Qiu Songyn overnight stay at Liviana Srl from 18/09/16 to 28/09/16, Ord. 3541/2016, Invoice nr. 34 dated 30/09/16, Payment order 1079 dated 25/11/16
		€ 599,54	Ye Min overnight stay at Liviana Srl from 18/09/16 to 28/09/16, Ord. 3541/2016, Invoice nr. 34 dated 30/09/16, Payment order 1079 dated 25/11/16
		€ 179,98	Ord. 4331/2016 Dinner at Zairo Filimbeni Srl, Invoice nr. 13 dated 28/09/16, Payment order 1079 dated 25/11/16
Sub-total	€ 27.829,84	€ 11.875,37	
Honorary - Expert External Consultant Massimo Rumor	€ 3.600,00		
Sub-total	€ 3.600,00	€ 0,00	
Meeting/Workshop/Training 1			
Organisation cost (venue, printed material, etc.)			
Translation Workshop in Guangzhou 14-15/05/15	€ 2.870,00	€ 3.003,69	Ord. 5203/2015 Translation expenses Beijing Ciyundacheng Information & Technology Co. Ltd - Invoice nr. 20150610 dated 15/06/15 - Payment order nr. 1304 dated 31/12/15
		€ 434,82	Ord. 5203/2015 Chen Ke flight tickets - Payment order nr. 1304 dated 31/12/15
Total travel cost (flights, visas, etc.) Workshop in Guangzhou 14-15/05/15		€ 346,14	Ord. 5203/2015 Qiu Songyn flight tickets - Payment order nr. 1304 dated 31/12/15
		€ 346,14	Ord. 5203/2015 Liu Xiaofei flight tickets - Payment order nr. 1304 dated 31/12/15
		€ 145,89	Ord. 5203/2015 Chen Ke hotel expenses - Payment order nr. 1304 dated 31/12/15
Total per diem Workshop in Guangzhou 14-15/05/15	€ 2.382,83	€ 486,31	Ord. 5203/2015 Qiu Songyn hotel expenses - Payment order nr. 1304 dated 31/12/15
		€ 486,31	Ord. 5203/2015 Liu Xiaofei hotel expenses - Payment order nr. 1304 dated 31/12/15
Sub-total	€ 5.252,83	€ 4.762,99	

Meeting/Workshop/Training 2			
Organisation cost (venue, printed material, etc.)	€ 6.760,00		
Total travel cost (international travel)	€ 8.200,00		
Total travel cost (within China)	€ 2.500,00		
Total per diem	€ 5.718,80		
Sub-total	€ 23.178,80		
TOTAL	€ 132.380,00	€ 40.387,18	
Remaining funds to date	€ 91.992,82		
INCOME (Payments from OIE)	Amount	Date received	
First payment	€ 66.000,00	13/08/14	
Intermediary payment			
Final payment			
Total income to date	€ 66.000,00		
BALANCE	Amount		
Total income	€ 66.000,00		
Total expenditure	€ 40.387,18		
Balance	€ 25.612,82		