

The use of GIS in animal disease response

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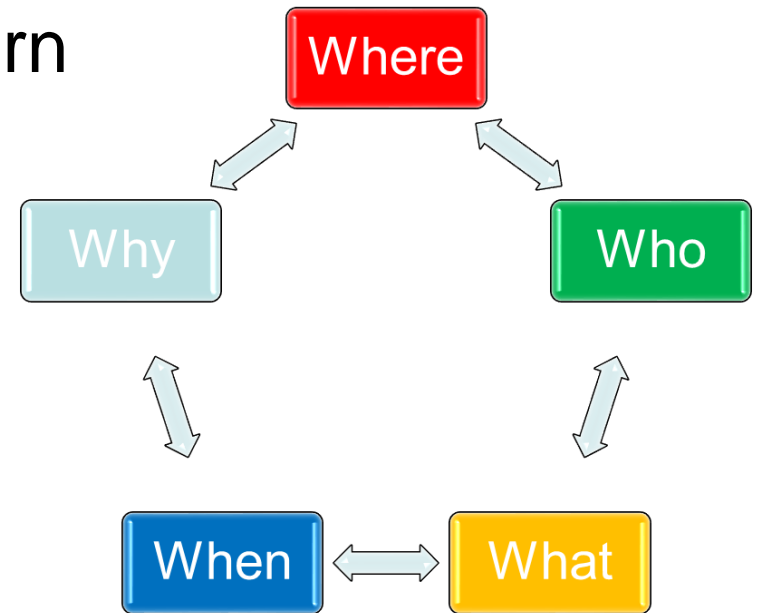
OIE Headquarters



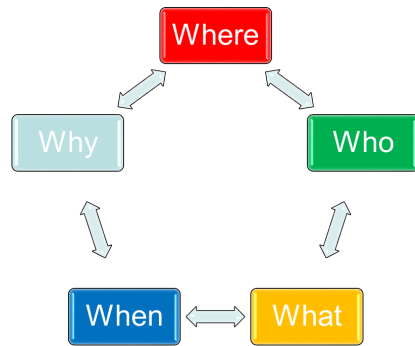
Disease events

The 5W's of epidemiology:

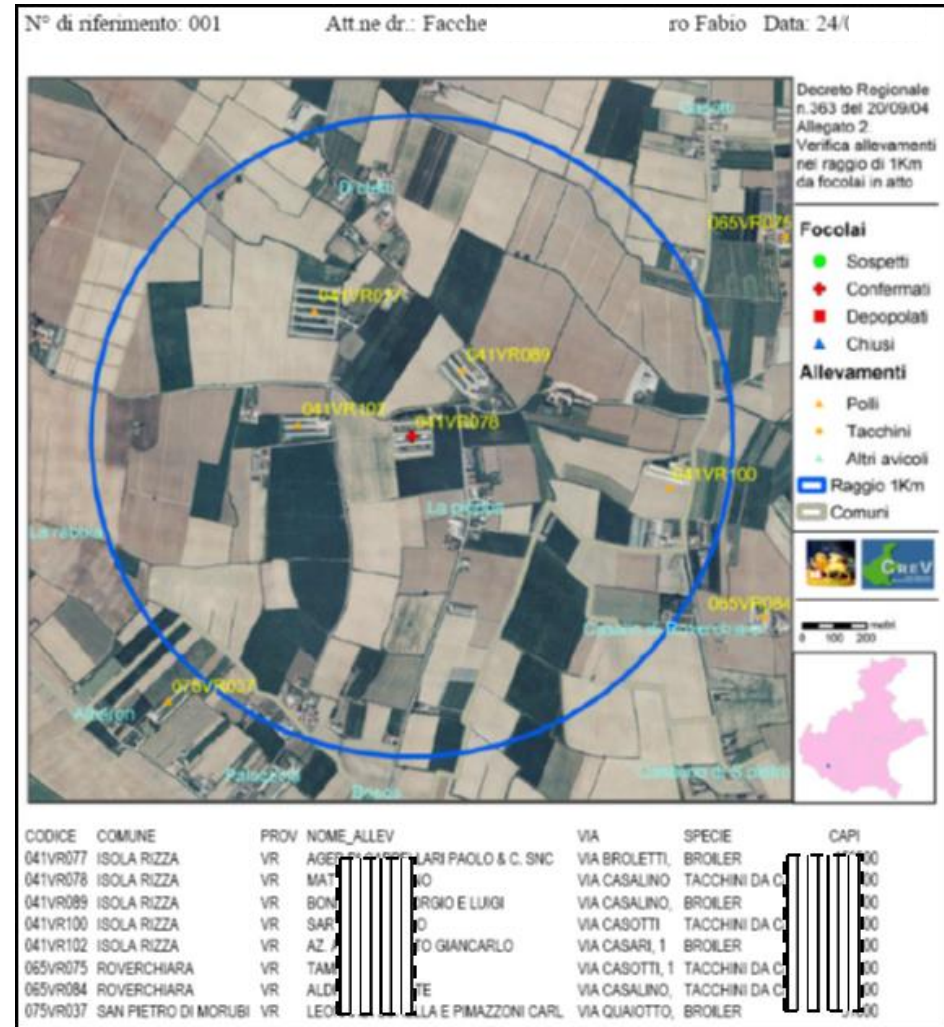
1. What = health issue of concern
2. Who = animals
- 3. Where = location**
4. When = time
5. Why/how = causes, risk factors, modes of transmission



Disease events

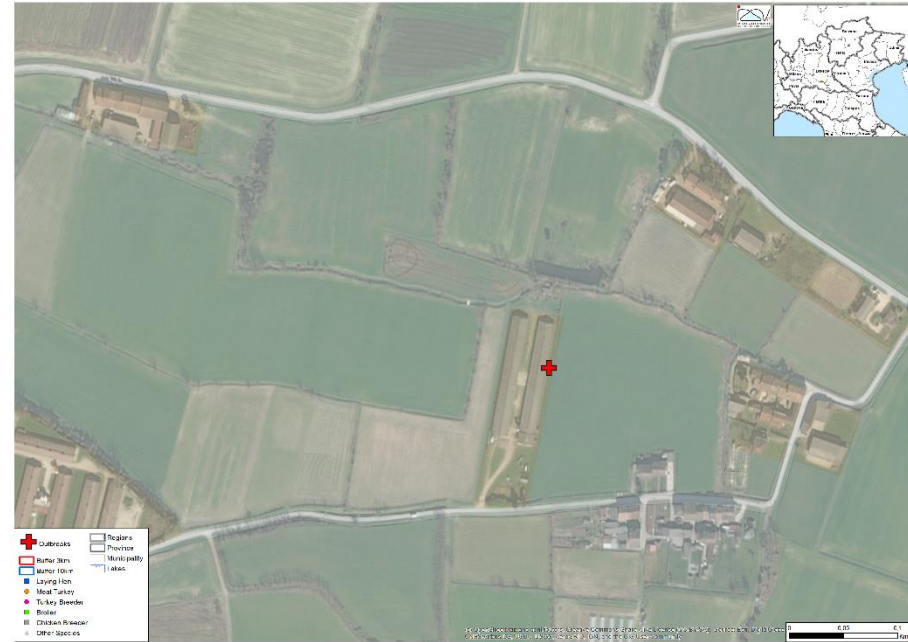


The spatial component of a disease outbreak has always been a basic element to **identify, describe..... characterize = control** a livestock disease



Disease response

- Identification of the location of an outbreak
- To organise disease control operations (protection and surveillance zones, stamping out, vaccination,..)
- To characterise the area at risk of infection (e.g. DPLA)
- To elaborate the first hypothesis on the origin of the disease (e.g. wet area for AI)



- *Farm code*
- *Address*
- *Animal species*
-

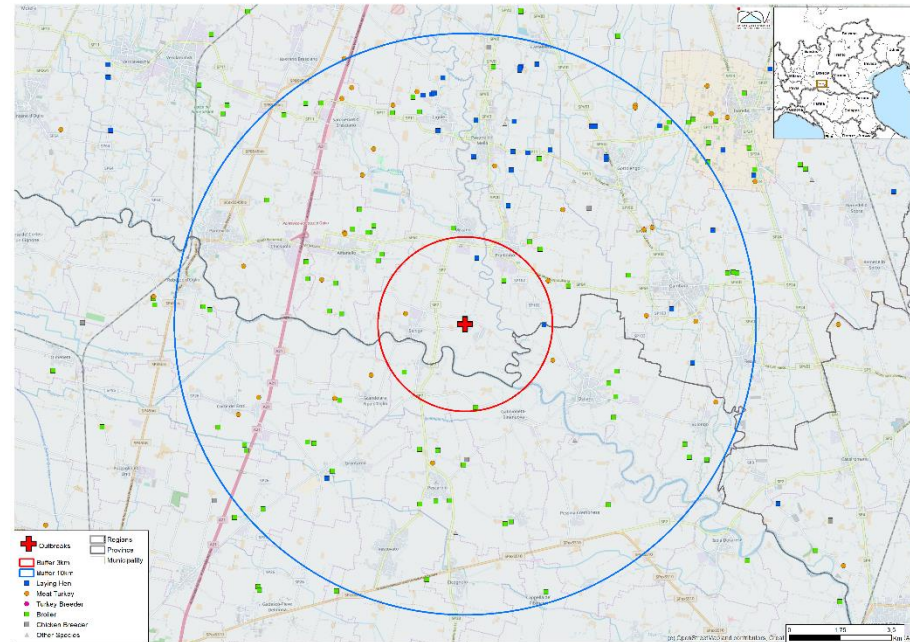
Source:

Farm register database

Ancillary map (*image, street maps*)

Disease response

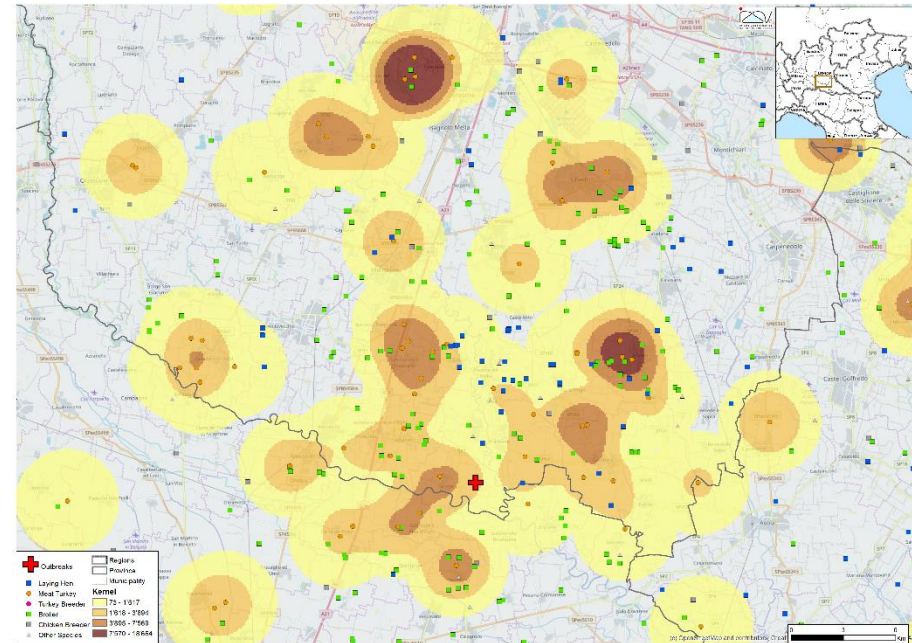
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- *Procedures*
- *GIS tools*

Disease response

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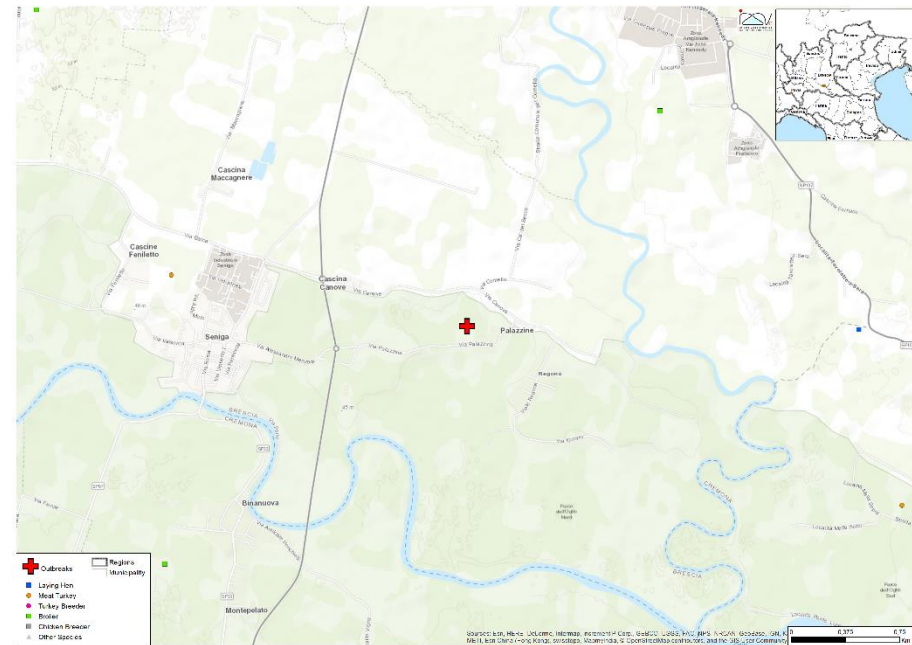


- *Procedures*
- *Exploratory Spatial Data Analysis*

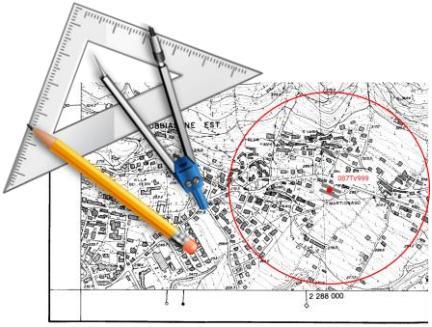
Disease response

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- *Ancillary data*
- *Satellite data*



Disease response – the role of GIS



Historically the geographical component of an animal disease response was studied and managed using paper maps



Disease response – the role of GIS

NO = many outbreaks

You **MUST** guarantee the enforcement of restrictions in areas at-risk:

- disease control
- trade



Disease response – the role of GIS

Why an organisation should invest (money, time, commitment, ..) to build a GIS?

GIS RETURN ON INVESTMENT

- IMPROVE EFFICIENCY
- INCREASE PRODUCTIVITY
- SAVE TIME
- SAVE LIVES
- IMPROVE INFORMATION PROCESSING
- COMPLY WITH STATE AND FEDERAL MANDATES
- PROTECT YOUR COMMUNITY
- IMPROVE COMMUNICATION, COORDINATION, AND COLLABORATION
- PROVIDE DATA TO REGULATORS, DEVELOPERS, AND OTHER INTERESTED PARTIES
- RESPOND MORE QUICKLY TO CITIZEN REQUESTS
- IMPROVE CITIZEN ACCESS TO GOVERNMENT
- EFFECTIVE MANAGEMENT OF ASSETS AND RESOURCES

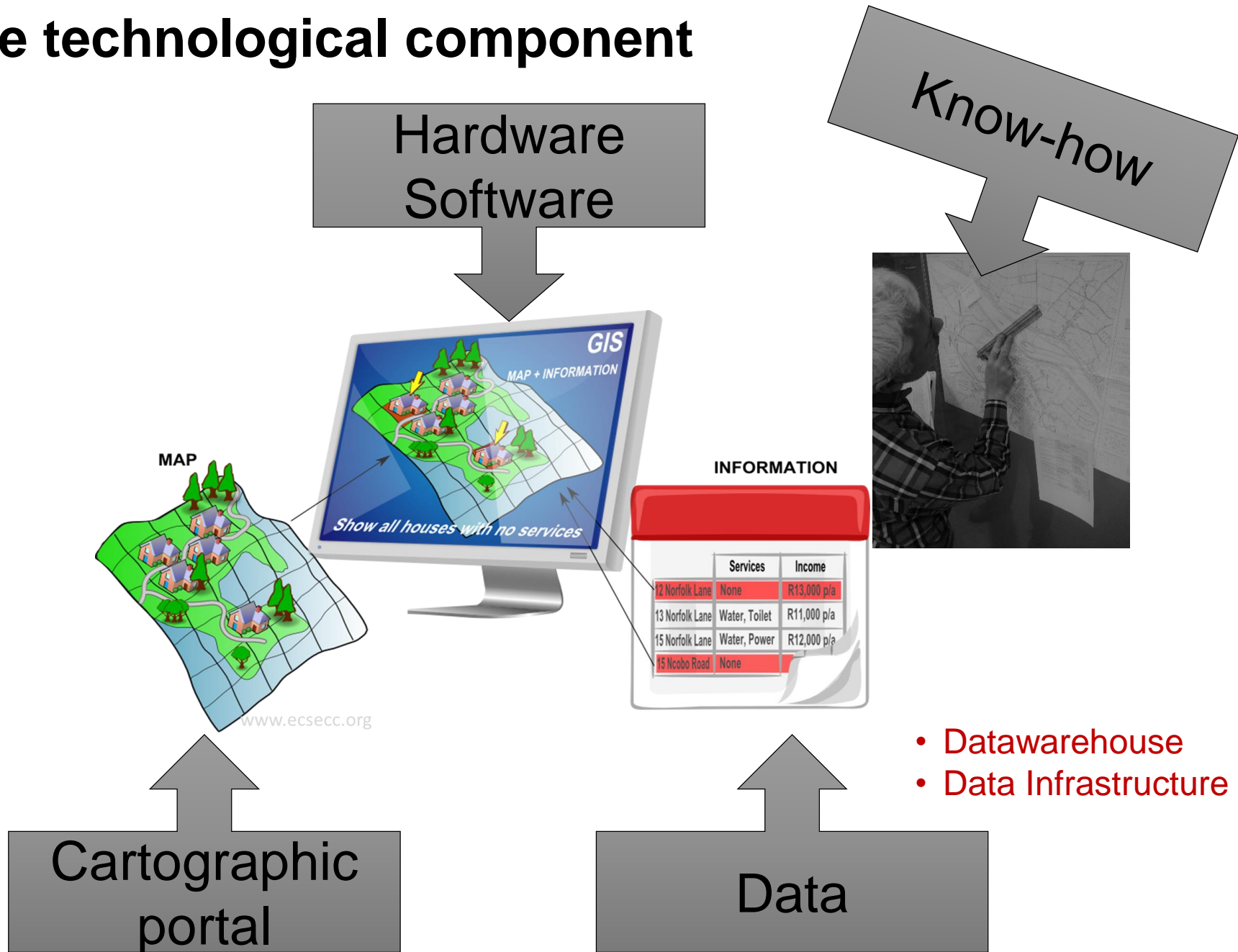
Save time

Take better decisions

Improve data accuracy

Source: Hinton and Holdstock, 2010

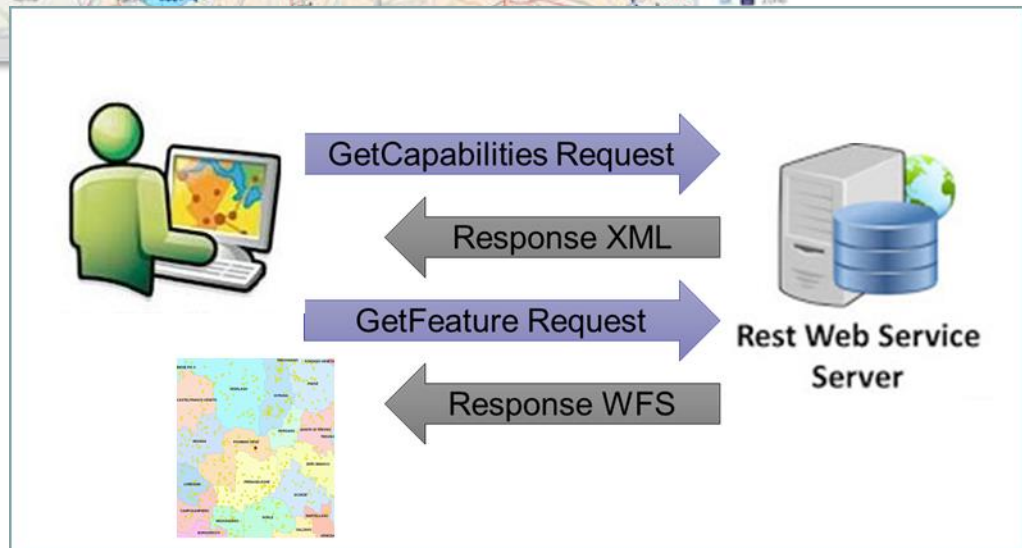
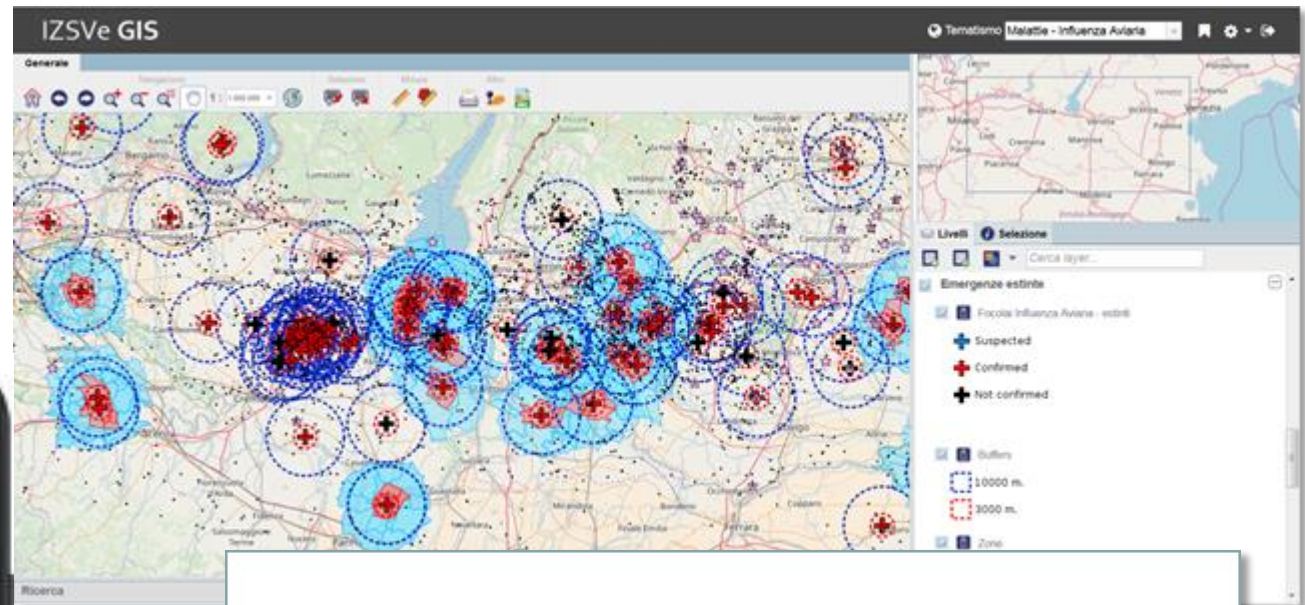
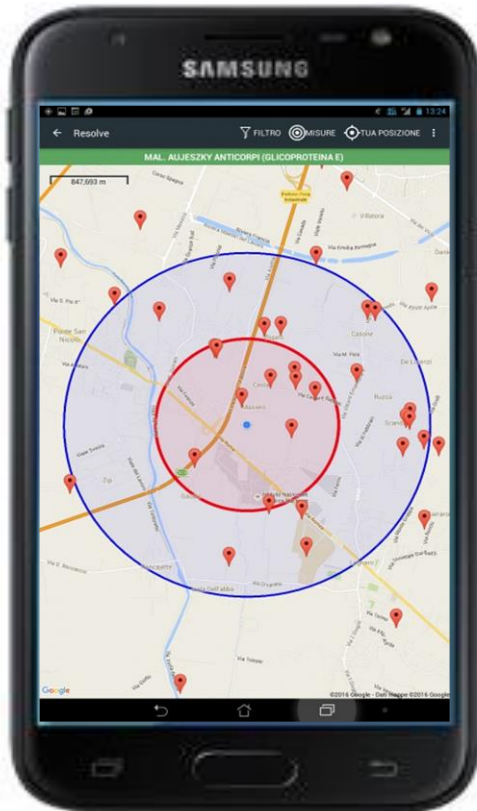
The technological component



The technological component

WebGIS

App



WebServices

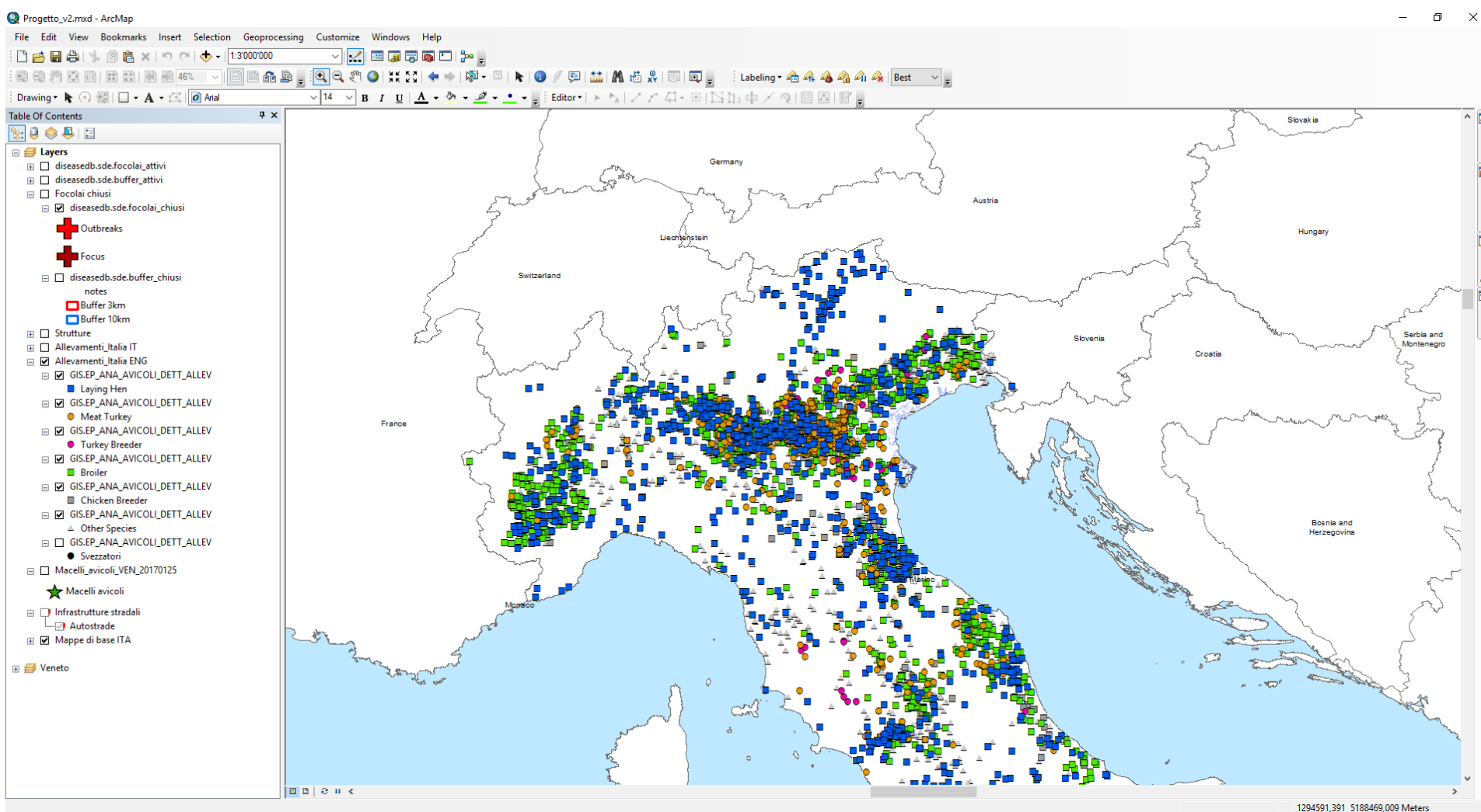
Disease events

HPAI



Applications – AI Management – Preparedness

Step 1 – peace time: set up data, procedures and methods



Applications – AI outbreak management

Step 2: to identify the location of the AI affected poultry farm

The screenshot displays the ArcMap interface for a project named 'Progetto_v2.mxd'. The main map area shows a geographical view of Italy with various locations labeled, including Verona, Butapetra, San Giovanni Lupatoto, and others. A 'Select By Attributes' dialog box is open, showing the following configuration:

- Layer: GIS_EP_ANA_AVICOLI_DET_TALLEV_tac
- Method: Create a new selection
- Attributes: LUOID, LUOCOD, LUOIND, LUOINSCAP, LUOCODISTAT
- Query: `SELECT * FROM GIS_EP_ANA_AVICOLI_DET_TALLEV WHERE LUOCOD = '032VR086'`

The map shows several data points represented by colored squares and circles. A pink star is placed on the map, indicating the location of the AI affected poultry farm. The 'Table Of Contents' on the left lists various layers, including 'diseasedb.sde.focolai_attivi', 'diseasedb.sde.buffer_attivi', 'Focolai chiusi', 'diseasedb.sde.focolai_chiusi', 'Outbreaks', 'Focus', 'diseasedb.sde.buffer_chiusi_notes', 'Buffer 3km', 'Buffer 10km', 'Struttura', 'Allevamenti_Italia IT', 'Allevamenti_Italia ENG', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Laying Hen', 'Meat Turkey', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Turkey Breeder', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Broiler', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Chicken Breeder', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Other Species', 'GIS_EP_ANA_AVICOLI_DET_TALLEV', 'Svezatori', 'Macelli_avicoli_VEN_20170125', 'Macelli_avicoli', 'Infrastrutture stradali', 'Autostrade', 'Mappe di base ITA', 'Cartografia ISTAT', 'ITA', 'gis_os.sde.reg_ita', 'Regions', 'gis_os.sde.prov_ita', 'Province', 'gis_os.sde.Comuni', 'Municipality', 'comuni_italia_locale', 'Municipality', and 'FVG.Laquina FVG'.

Applications – AI outbreak management

Step 3: AI affected poultry farm (data check)

- Farm code
- Farm name
- Species and type of production
- Number of birds
- Restocking date
- Last AI inspection/test

The screenshot shows the ArcMap interface with a map of Italy. The Table of Contents on the left lists several layers, including 'GIS.EP' and 'GIS.EP_ANA_AVICOLI_DETT_ALLEV'. The Identify window on the right displays the following data for a selected feature:

Field	Value
LUOID	3137546
LUOCOD	032VR086
LUOIND	VIA CAVECCHIA N. 3
LUOINSCAP	37060
LUOCODISTAT	023032
LUODESCOM	ERBÈ
LUOCODASL	9
LUOSIGLAPROV	VR
LUODESPRO	VERONA
LUOREG	050
LUODESREG	VENETO
PROP_ANADESCOM	
RES_ANADESCOM	TIZIANI SIMONE
RAS_ANADESCOM	SOC. AGR. LA PELLEGRINA S.P.A
AVIID	21945
AVITEMID_VALSTART	1
AVITEMID_VALEND	33237
AVIANAIID_RAS	4651
AVIANAIID_RES	85120
AVIANAIID_ESITIT	4651
AVIDATA_VALSTART	01/01/2010
AVIDATA_VALEND	31/12/2100
AVIELAB	72783
AVISYNGRO_PK	7102
RASCOD	K490347
RASINSCOD	V13583
RASANACODRAS	H03768
RASANACODRAL	H03768
RASDATAINIZ	31/12/2004
RASDATAFINE	31/12/2100
RASDATAACREA	02/04/2015 13:16:01

Applications – AI outbreak management

Step 5: restriction zones

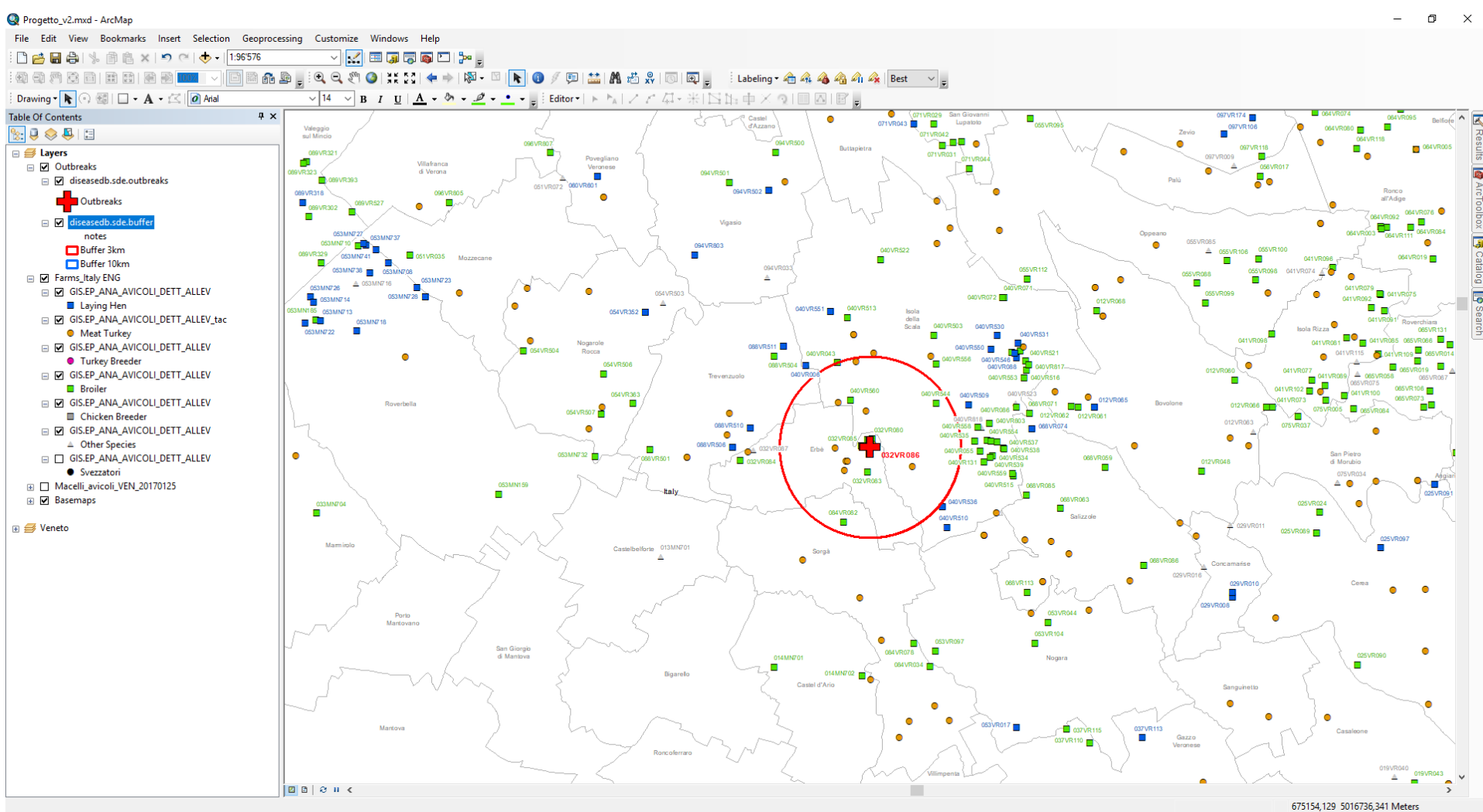
Field veterinarians

- Enforcement of restrictions
- Stamping out measures
- Disposal of carcasses
- Cleansing and disinfection



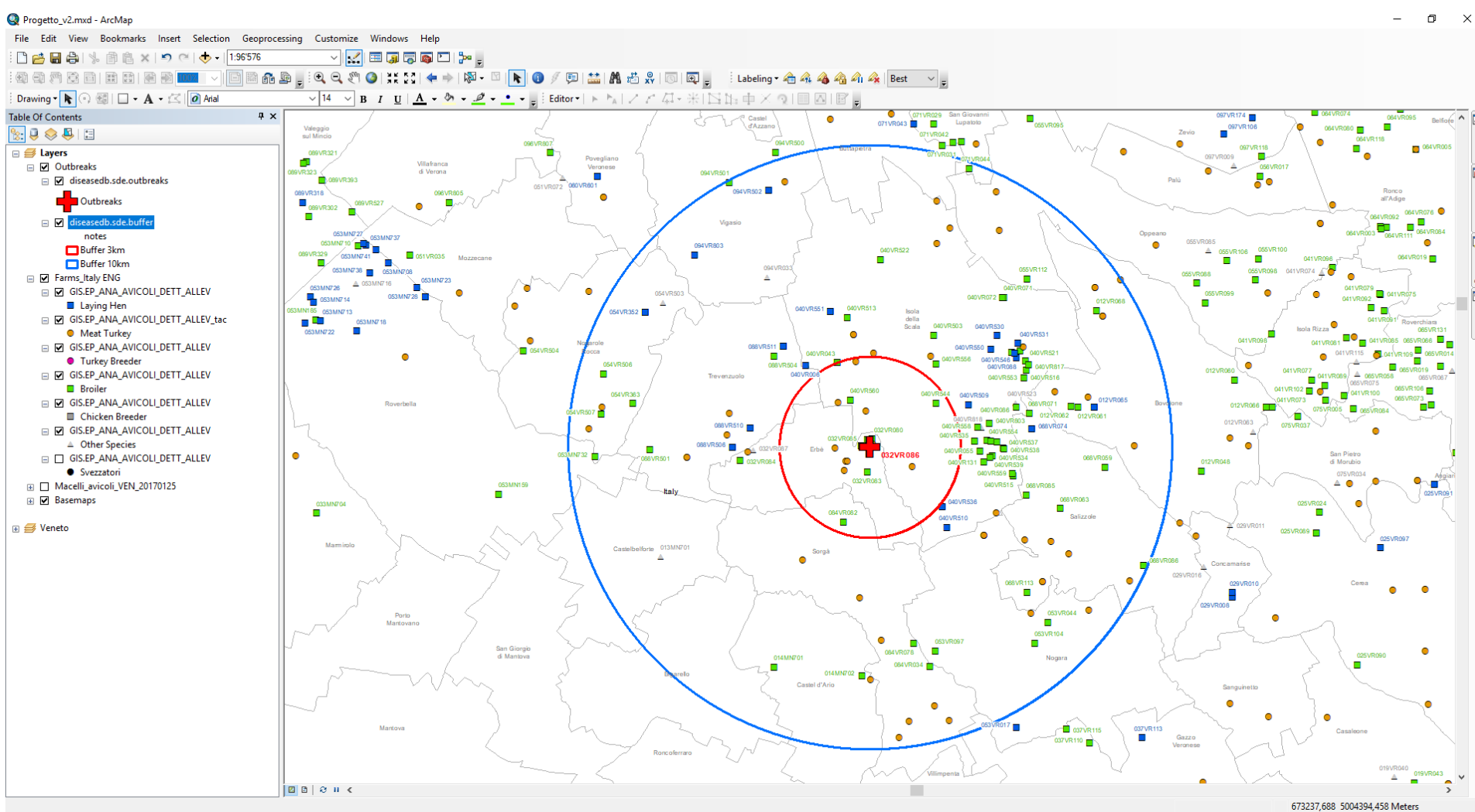
Applications – AI outbreak management

Step 4: protection zone



Applications – AI outbreak management

Step 5: surveillance zone



Applications – AI outbreak management

Step 6: list of poultry farms within the restricted areas

The screenshot shows the ArcMap interface with the following elements:

- Table of Contents:** Lists layers including 'Outbreaks', 'diseasdb.sde.outbreaks', 'GIS.EP_ANA_AVICOLI_DETT_ALLEV', and 'Farms_Italy ENG'.
- Map:** Displays a map of a region with numerous farm locations marked by colored dots (red, blue, green, orange) and labeled with IDs like '032VR086', '040VR560', and '040VR551'. Two circular buffers are overlaid: a large blue one and a smaller red one.
- Select By Location Dialog:** Opened in the foreground, showing the following configuration:
 - Selection method:** select features from
 - Target layer(s):** GIS.EP_ANA_AVICOLI_DETT_ALLEV (checked)
 - Source layer:** diseasdb.sde.buffer
 - Spatial selection method for target layer feature(s):** are within the source layer feature
 - Apply a search distance:** 2000,000000 Meters

Applications – AI outbreak management

Step 6: list of poultry farms within the areas – export data

The screenshot displays the ArcMap interface with a map showing various poultry farms. A blue buffer zone is visible around a specific farm. An Excel spreadsheet is overlaid on the map, showing a list of farms with their details. The spreadsheet has columns for DISTANZA, CODICE AZI, INDIRIZZO, COMUNE, PROVINCIA, REGIONE, SPECIE, TIPO, ORIENTAM, FASE, PROD, MODALITA, CAPACITA, P, RESPONSA, REGIONE, SI, AVIHD, LUODESC, and LUODESPRC.

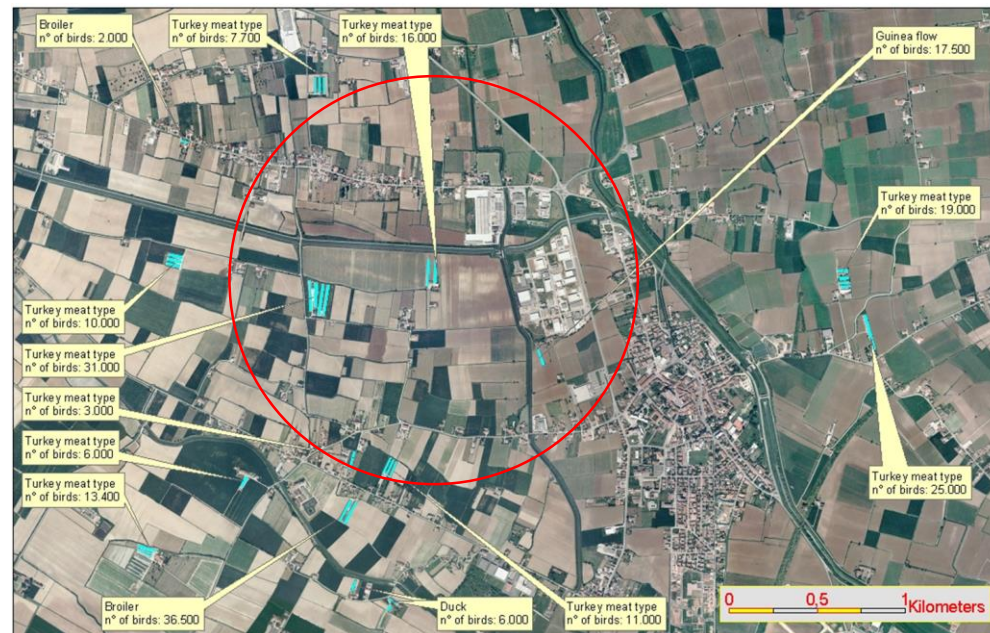
	A	B	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1																		
2	1		0,00	032VR086	VIA CAVECCIERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	7500,00	TIZIANI SIMC	SOC. AGR. LF	21945,00	ERBE	VERONA
3	2	1	117,97	032VR093	VIA CA' VECCERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	39000,00	TIZIANI ENZC	SOCIETA' AG	65037,00	ERBE	VERONA
4	3	1	137,34	032VR089	VIA CAVECCIERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	13600,00	CARPANESE	SOC. AGR. LF	21801,00	ERBE	VERONA
5	4	1	265,32	032VR081	VIA CAVECCIERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	48000,00	TIZIANI MAUS	SOCIETA' AG	65038,00	ERBE	VERONA
6	5	1	278,75	032VR080	VIA CA' VECCERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	35000,00	TIZIANI DAN	SOCIETA' AG	65069,00	ERBE	VERONA
7	6	1	278,75	032VR080	VIA CA' VECCERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	17600,00	TIZIANI FLAV	SOCIETA' AG	65070,00	ERBE	VERONA
8	7	1	297,99	032VR085	VIA PARECCIERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	78000,00	TOSATO RIN	SOCIETA' AG	17707,00	ERBE	VERONA
9	8	1	297,99	032VR085	VIA PARECCIERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	98000,00	LADY AVICOI	SOCIETA' AG	25043,00	ERBE	VERONA
10	9	1	816,29	032VR083	VIA FIORANEERBE	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	38000,00	PATUZZI MA	SOC. AGR. LF	64883,00	ERBE	VERONA
11	10	1	875,69	032VR095	VIA CASTELLI'ERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	20000,00	AZIENDA AG	SOC. AGR. LF	17569,00	ERBE	VERONA
12	11	1	935,84	032VR090	VIA CASTELLI'ERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	15000,00	AZ. AGR. PAI	SOC. AGR. LF	17566,00	ERBE	VERONA
13	12	1	1149,64	032VR091	VIA CASTELLI'ERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	26000,00	PATUZZI GIC	SOC. AGR. LF	57094,00	ERBE	VERONA
14	13	1	1155,97	032VR092	VIA CENTEN'ERBE	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	10000,00	SOCIETA' AG	SOC. AGR. G.	23112,00	ERBE	VERONA
15	14	1	1217,13	040VR450	VIA PALAZZII ISOLA DELLA VR	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	16000,00	PATUZZI GAIS	SOCIETA' AG	58978,00	ISOLA DELLA VERONA	
16	15	1	1528,12	040VR511	VIA CAMAGFI ISOLA DELLA VR	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	15000,00	CRISTOFOLI	'MANGIMIFIC	18025,00	ISOLA DELLA VERONA	
17	16	1	1686,77	040VR560	VIA CROSONISOLA DELLA VR	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	78800,00	GIOVANNON	SOC. AGR. LF	64882,00	ISOLA DELLA VERONA	
18	17	1	1810,71	040VR517	VIA CROSONISOLA DELLA VR	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	18800,00	GIULIARI NIC	SOC. AGR. LF	24043,00	ISOLA DELLA VERONA	
19	18	1	2620,29	084VR082	VIA CAMPAC SORGA	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	39990,00	SOC. AGR. CI	SOC. AGR. LF	23158,00	SORGA	VERONA
20	19	1	2627,10	040VR544	VIA TOCCOLI ISOLA DELLA VR	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	34000,00	TESCAROLI	PSOC. AGR. LF	64917,00	ISOLA DELLA VERONA	
21	20	1	2734,16	032VR100	VIA SAN CAR'ERBE	VR	VENETO	AVICOLI MIS	ALLEVAMEN'	SVEZZAMEN'	Indeterminat	NON INDICA	6197,00	FATTORIA C	FATTORIA CC	64704,00	ERBE	VERONA
22	21	1	2874,59	040VR805	VIA SCHIOPFI ISOLA DELLA VR	VR	VENETO	TACCHINI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	11200,00	CORTE SCHIK	SOC. AGR. LF	17574,00	ISOLA DELLA VERONA	
23	22	1	3017,84	040VR043	LOC. CANOVISOLA DELLA VR	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	17000,00	AVICOLA PIN	AZ. AGR. CECC	59242,00	ISOLA DELLA VERONA	
24	23	1	3017,84	040VR043	LOC. CANOVISOLA DELLA VR	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	22000,00	PERBELLINI	RAZ. AGR. CECC	58843,00	ISOLA DELLA VERONA	
25	24	1	3021,68	040VR043	LOC. CANOVISOLA DELLA VR	VR	VENETO	GALLUS GALI	ALLEVAMEN'	POLLAME D#	Indeterminat	CONVENZIO	37000,00	PIAZZI	RAZ. AGR. CECC	62211,00	ISOLA DELLA VERONA	

Applications – AI outbreak management

Step 5: restriction zones

Epi-group

- Identification of poultry farms at risk of neighborhood spread
- Surveillance (inspection and testing,....)
- Planning eradication actions (buffer vaccination, pre-empty killing,..)



Applications – AI outbreak management

Step 5: restriction zones

Field veterinarians

- Surveillance
- Enforcement of restrictions and eradication measures



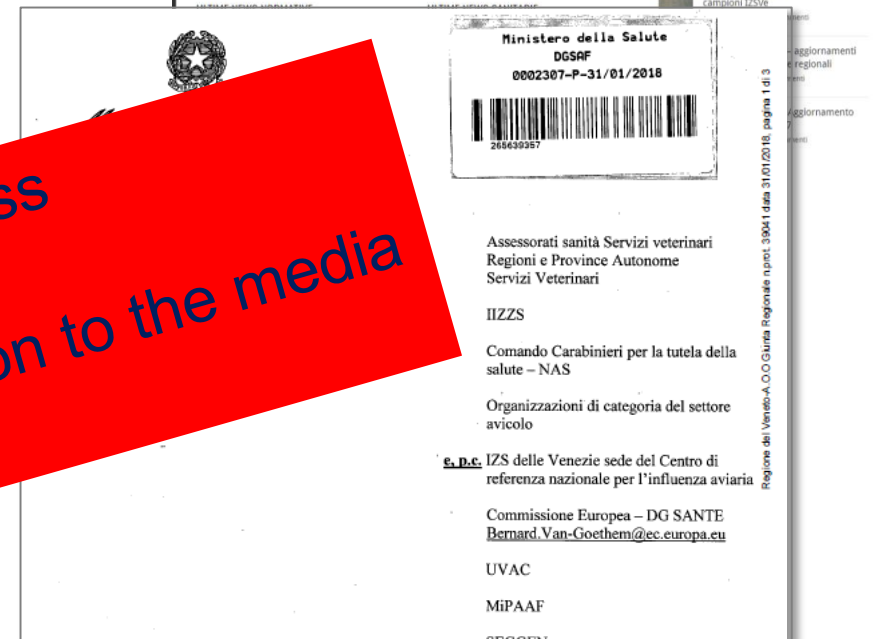
Applications – AI outbreak management

Step 5: restriction zones

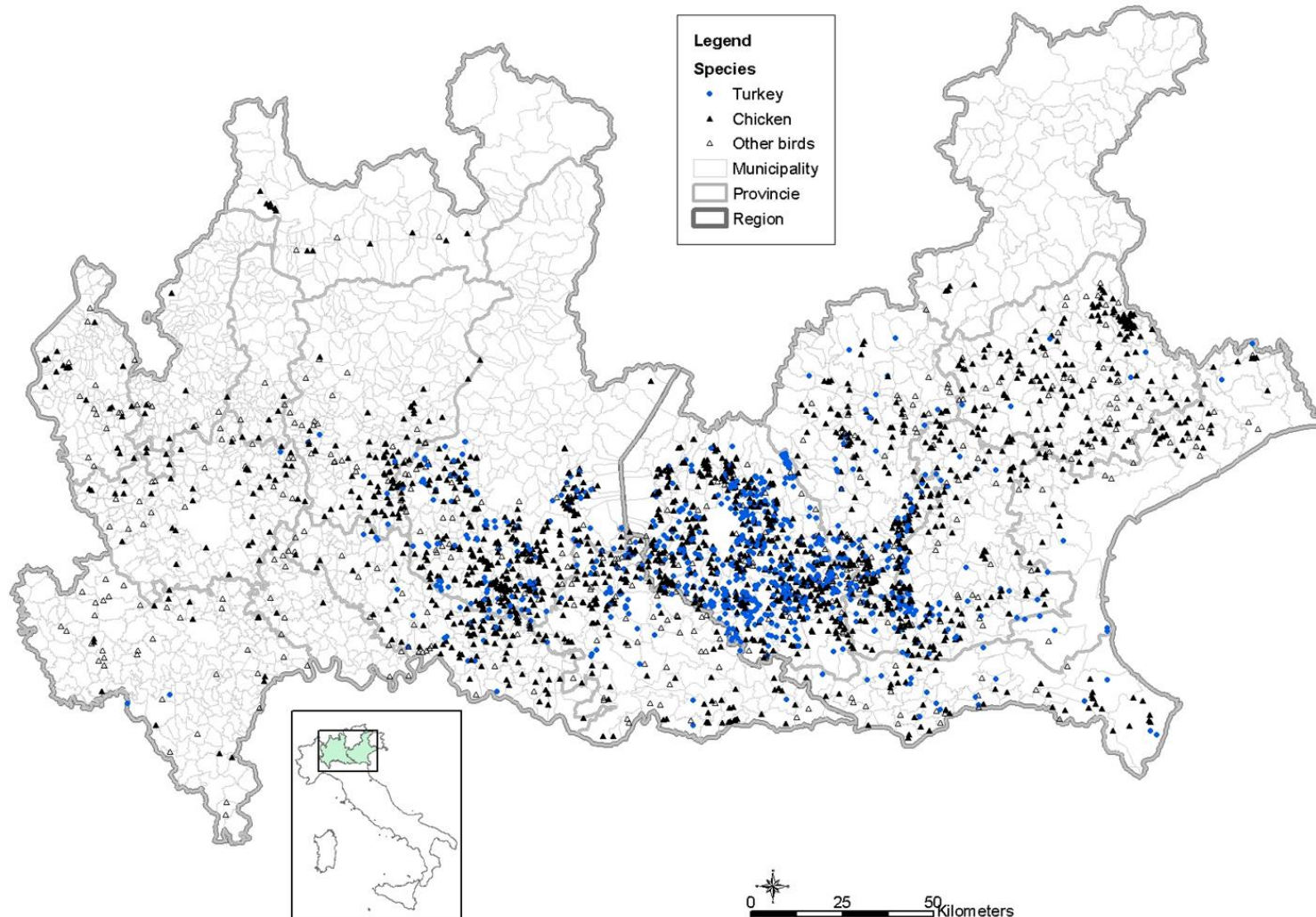
Communication

- Other organizations (local, national, international,..)
- Stakeholders
- Media

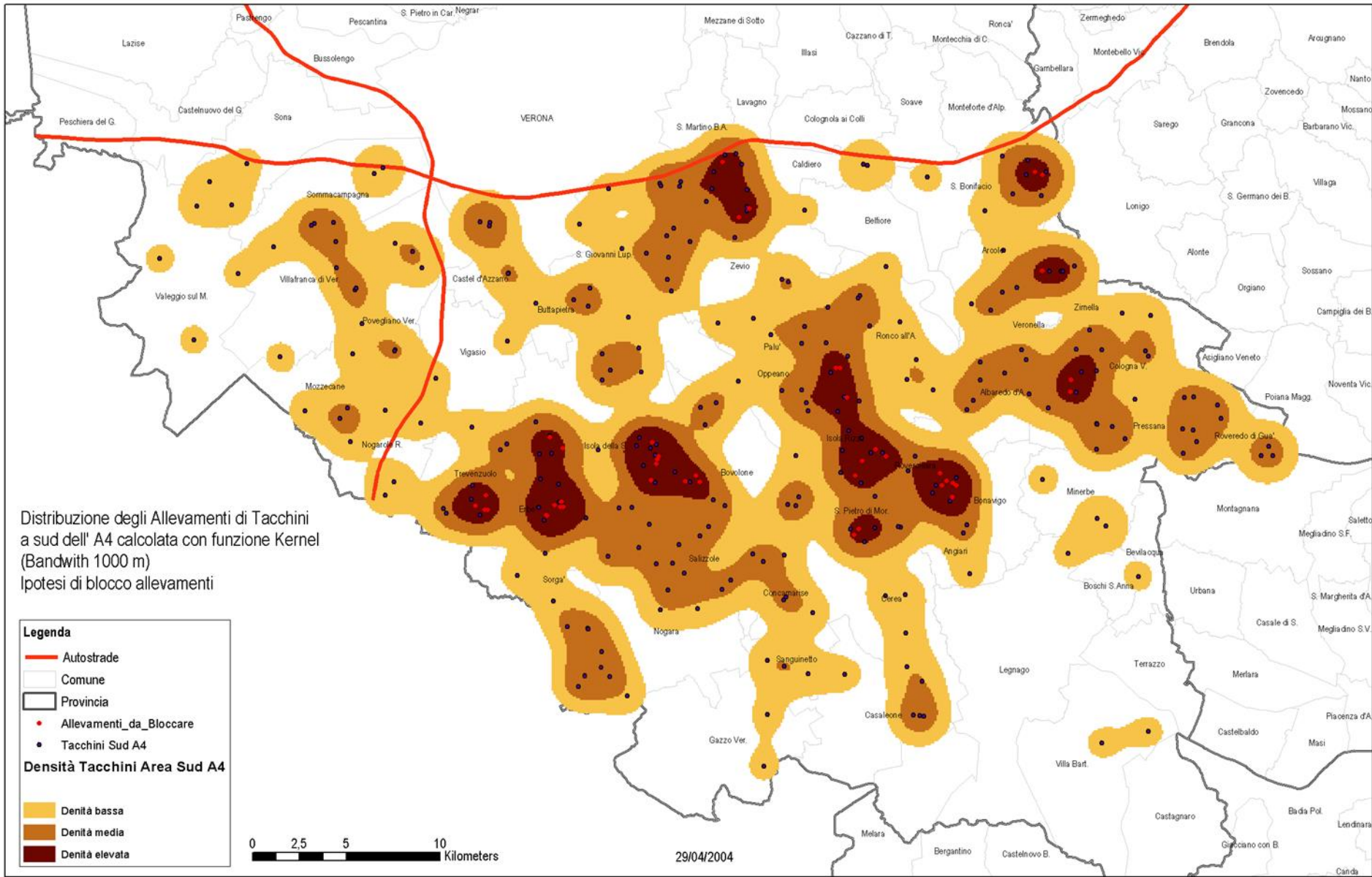
Increase awareness
Transparency
Proper information to the media
.....



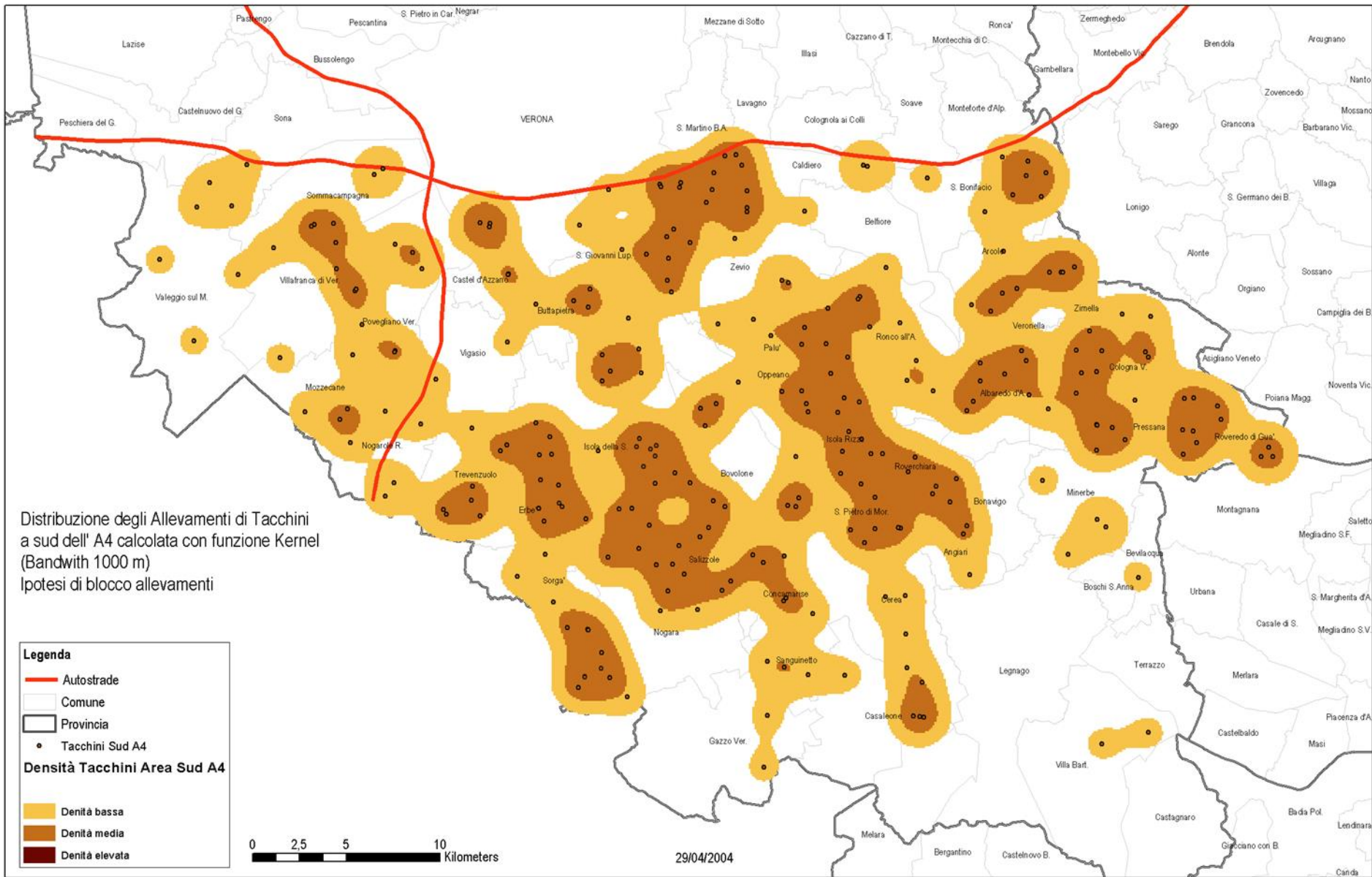
Poultry density in Italy



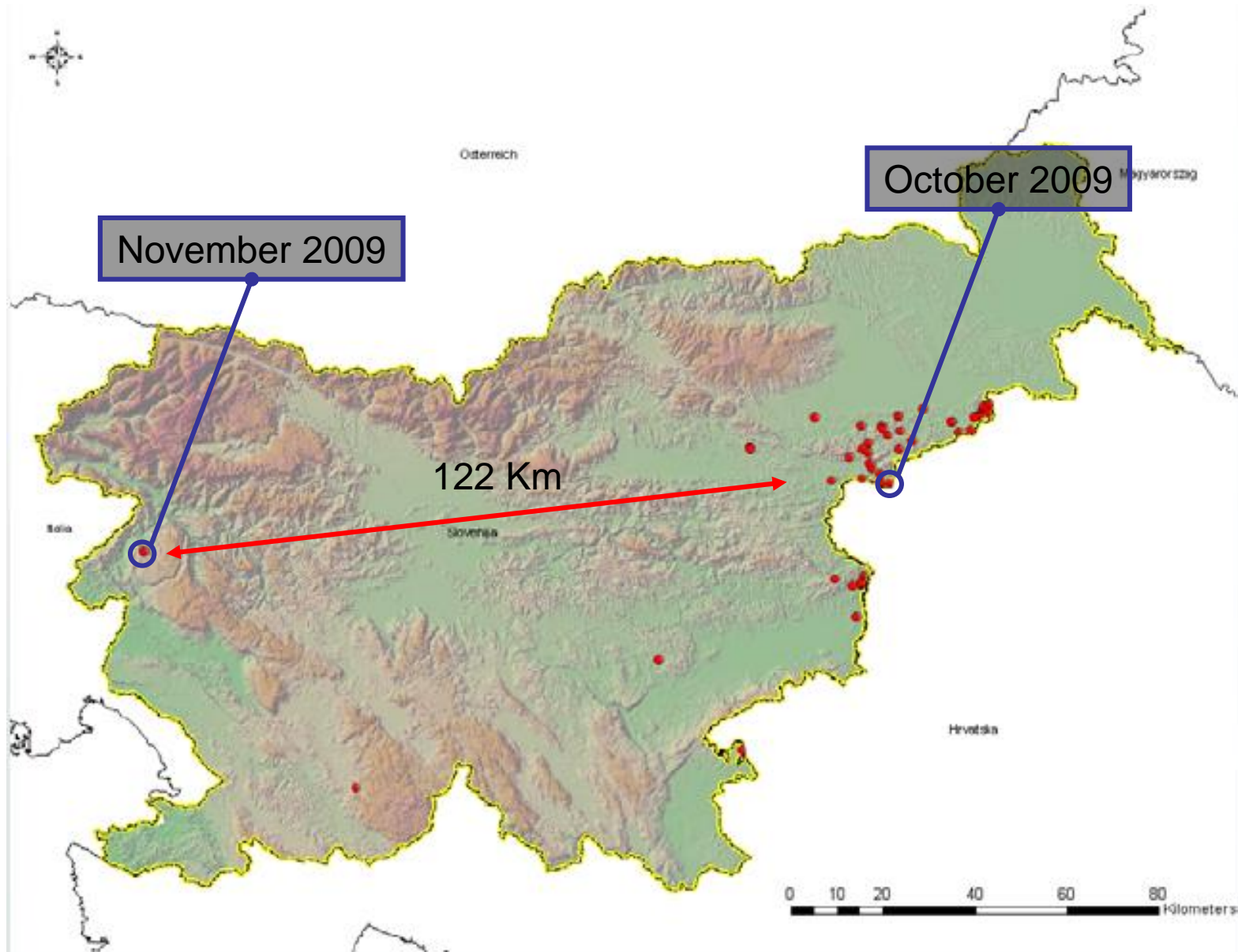
Application - DPPA



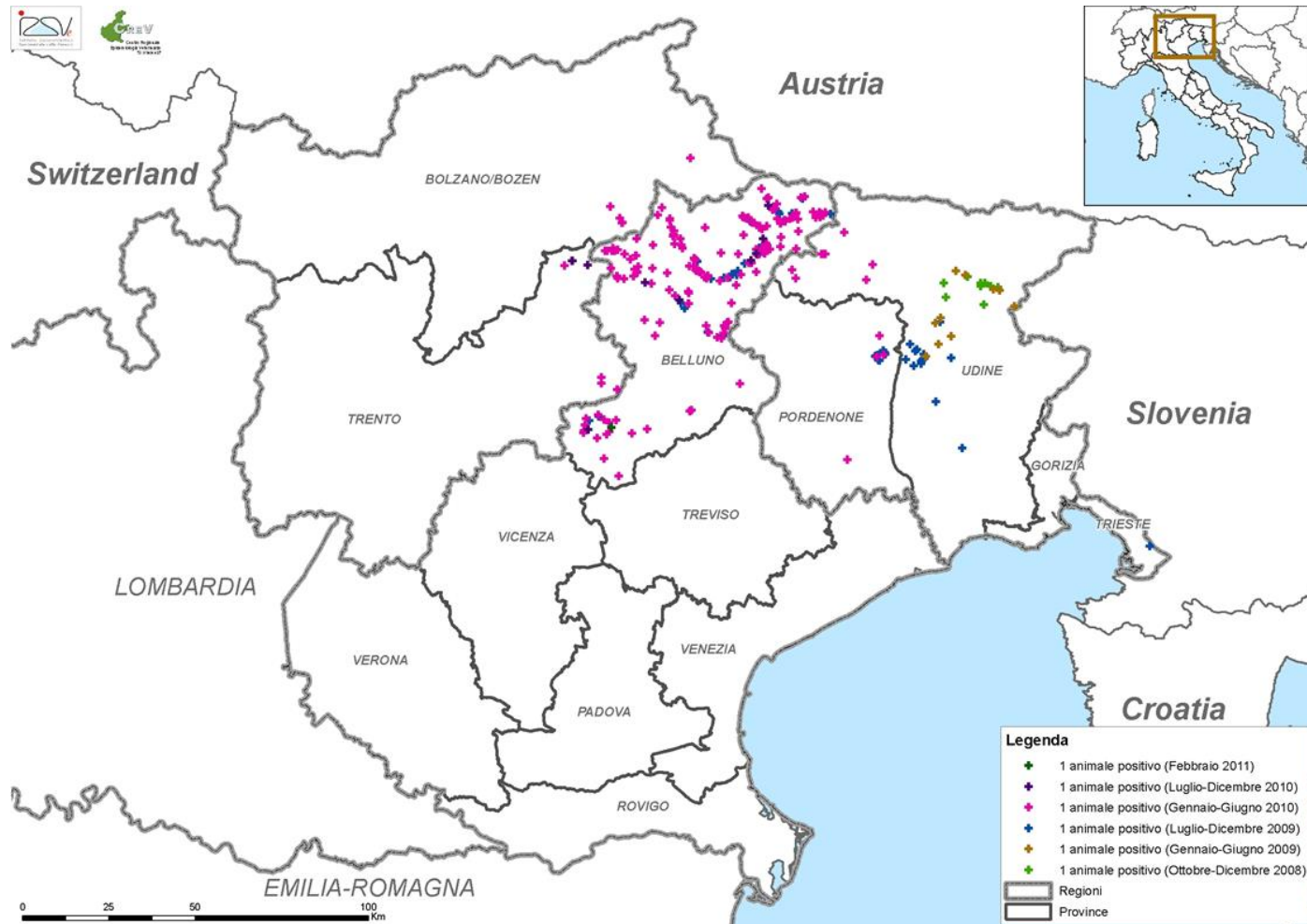
Application - DPPA



Application – Eradication of sylvatic rabies



Application – Eradication of sylvatic rabies

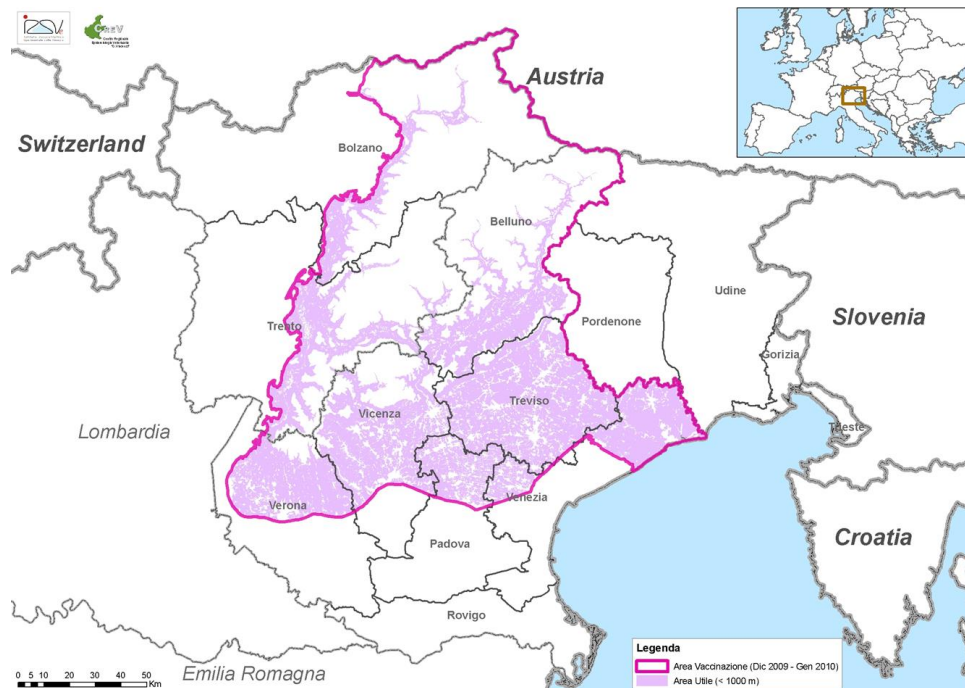


Application – Sylvatic rabies

GIS use in ORV implementation:

Precise definition of the vaccination areas - suitability

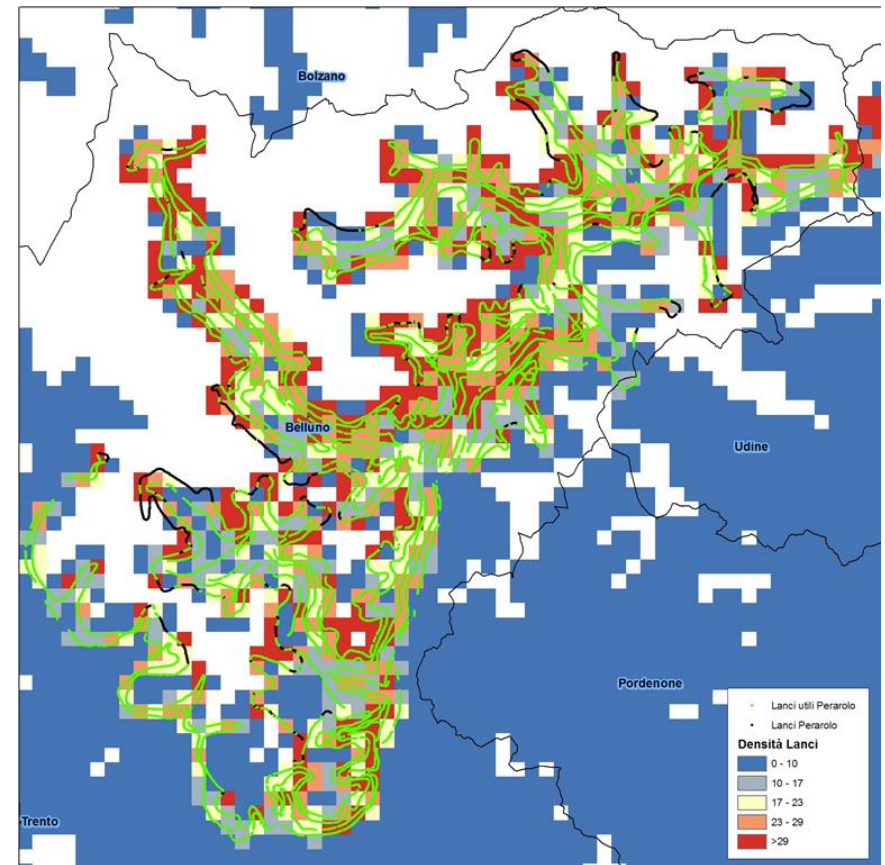
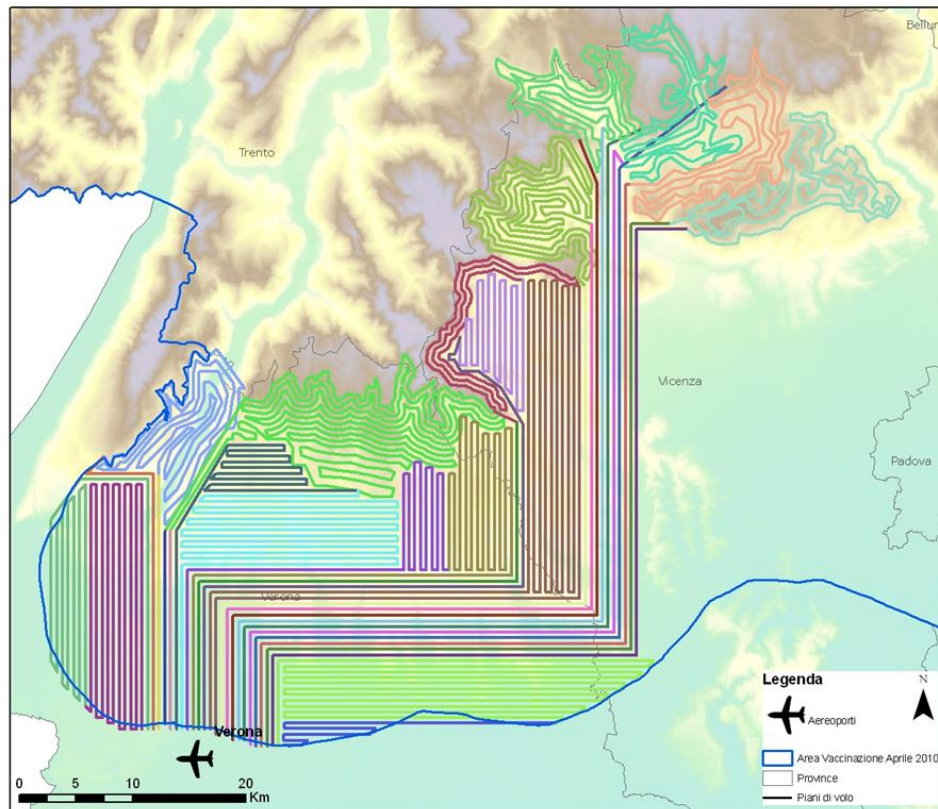
- Zone were foxes were unlikely to be found
- Zones where baits could not be dropped (cities, ...)
- Area below an average freezing point



Application – Sylvatic rabies

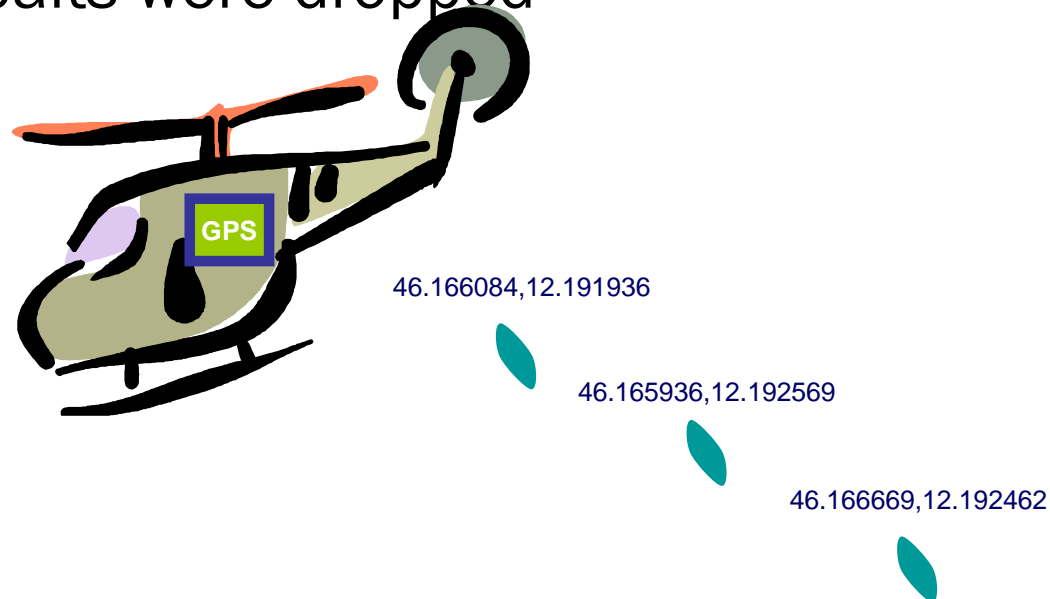
GIS use in ORV implementation:

Optimal flight paths for the helicopter



Application - Aerial distribution of vaccine baits

- **Aerial distribution** by helicopters, using a satellite-navigated and computer-supported automatic bait dropping system
- An electronic metronome connected to a GPS allowed the adjustment in dropping and recorded the coordinates where the baits were dropped



Application - Aerial distribution of vaccine baits



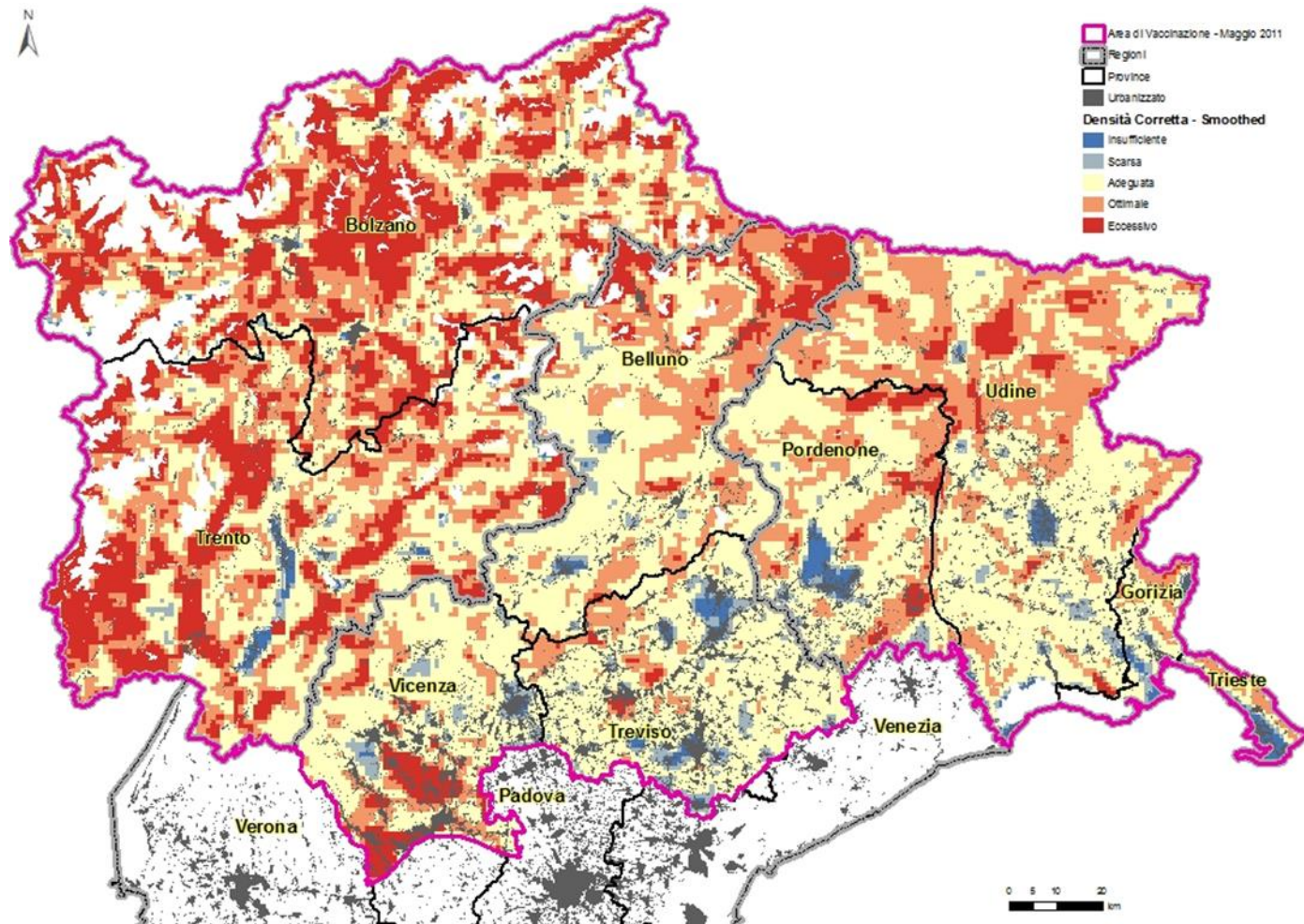
Satellite-navigated computer supported automatic system

- Constant and homogeneous release of baits
- Precise geographical localization of each dropped bait recorded on a file
- Maps with the precise trace of bait distribution

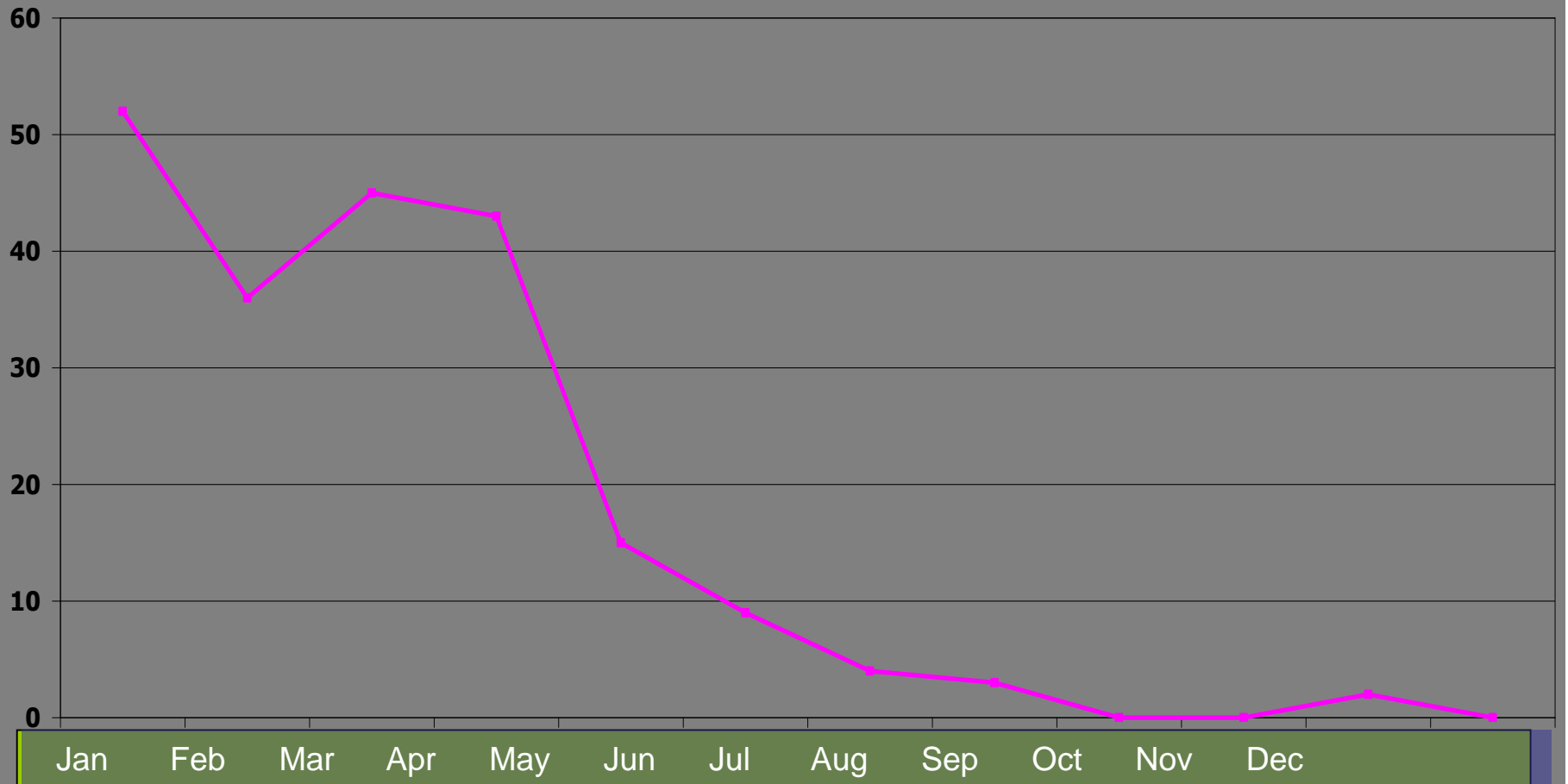
Application – Evaluation of vaccine bait distribution



Application – Sylvatic rabies



Monthly number of infected foxes – 2010



GIS - Conclusions

Historically the geographical component of an animal disease response was studied and managed using paper maps

Currently the technology to implement a GIS is readily available (limited investment)

Know-how for GIS use in the veterinary sector is well established



online course

The Use of GIS

in animal disease response

An empirical approach for the implementation of a GIS project to capture, manage and analyse spatial data related to disease events



www.izsvenezie.it