Chapter 107
Towards Spatial Decision Support System for Animals Traceability

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ABSTRACT

Animal traceability is a very important question for several government and private institutions from many points of view: economical, sanitary, etc. Traditional systems are able to memorize the main bovine movements, or to capture the geolocation of an animal using RFID. Now it should be possible to envisage a new generation of traceability systems in which the different locations are automatically recorded several times per day for each animal. These systems should also be coupled with analysis techniques to help decision-makers to take decisions, validate and/or reformulate their hypothesis. In this chapter the authors present a spatial decision support system dedicated to the animal geolocation acquisitions and analysis of possible sanitary problems. Indeed, in case of sanitary alerts, the system is able to determine the animals which have been in contact with a diseased animal exploiting historical trajectories of animals. It is applied to traceability of beef cattle using the Brazilian production system as a case study. OTAG focuses on improving methods and geotechnologies for recording reliable and accurate data on beef production.

INTRODUCTION

The availability of technological solutions to guarantee a reliable bovine traceability is very important for any beef producer. In 2008, for example Brazil leaded the ranking of beef exporter in the world, with 2.2 million tons, corresponding to US$ 5.3 billion (ABIEC, 2009). These values represent 28% of the international marketing of beef and commercial relations with 170 countries. Nowadays, this country is the second biggest beef producer with 8.9 million tons in 2008, while United Sates maintain the first position with 12.1 million tons and Europe, the third one, produces 8.2 million tons (SINDICARNE, 2009). The Brazilian beef production is developed all over the territory and it includes approximately 225 million hectares distributed in 2.2 millions properties, according to the Brazilian Institute of Geography and Statistics, and a bovine population of 199.7 millions animals in 2007 (IBGE, 2009), which corresponds to 15% of bovine population in the world. This is one of the productive chains with more employees, being responsible for 7.2 millions of direct jobs. The bovine meat agribusiness has been growing annually in Brazil at the same time it is being structured in a competitive way. In the last decade, the medium growth was approximately 30%, while the growth of the exports was superior to 200%. The Brazilian beef cattle productive chain is characterized by the creation of animals under grazing, by semi-intensive system (grazing with supplementation) or by the intensive system (grazing with supplementation and feed-lot), in which the animal is fed by grains, being forbidden the use of animal protein (except dairy products). Considering the economic and health aspects of the beef cattle for producer and consumer countries, the continuous use of agricultural techniques becomes essential to contribute with the increase of the production and to guarantee the final product quality. Furthermore, it is necessary to use information technology aiming at the collection and treatment of information throughout the productive chain, for accelerating the decision making in any stage of the production process.

This chapter sums up the studies undertaken during a project supported by the European Community about geolocation at a large scale applied to bovine traceability. This proposal is issued from the project "Operational management and geo-decisional prototype to track and trace agricultural production" (OTAG), which is a Specific Support Action of the 6th Framework Programme of the European Community. The goal of OTAG is to provide conditions to know the relative risks concerning to a bovine traceability, in the context of Southern Cone Countries and the EU policies. Hence, the Brazilian beef cattle production system was taken as case study. The project is based on the existing knowledge in Europe and Canada concerning to information systems and geo-decisional tools, as well to the interaction among experts and user groups from South Cone, Canada and Europe. The following institutions are partners in the project: Cemagref (France), Brazilian Agricultural Research Corporation (Embrapa, Brazil), Université Laval (Canada) and Cooperative Program for the Technological Development of the Agro-food and Agroindustry in the Southern Cone (Procisur, Argentine).

The mainly goals of OTAG is to propose a technological solution and a global architecture for a new generation of animal traceability systems. Thus, we propose three-tier architecture composed of an *acquisition layer*, a *data management layer* and a *spatial decision support layer*. The acquisition layer allows measuring the animal geolocations in the pastures, using electronic devices embedded in necklaces carried out by animals. Then, these data are centralized in a spatial database (data management layer). This layer represents semantics of bovine traceability applications, including concepts of production system, animals and their movements. The richness of these database models allows consumers, researchers, farmers and government employers to

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