

# **Multi-Agency Geographic Information for the Countryside; the MAGIC project**

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## **Introduction**

MAGIC (Multi-Agency Geographic Information for the Countryside) is a national, inter-organisational, shared resource of rural and countryside information accessed through a web-based Geographic Information System. The project has been led by the Department for Environment, Food and Rural Affairs (DEFRA) and the partner organisations in the project are: English Nature, English Heritage, Forestry Commission, Countryside Agency, Office of the Deputy Prime Minister and the Environment Agency.

The project has been financed by a Treasury fund set up to promote innovative work and joined up government and is in the third and final year of development.

MAGIC has been developed specifically to meet the needs of the seven partner organisations, but is openly available on the Internet at <http://www.magic.gov.uk>, where it was made public in May 2002.

## **1 Setting up MAGIC**

### **1.1 Driving Forces**

All partner organisations have a shared interest in the development and implementation of rural and countryside policies in England. This involves the collection and use of information on a wide range of countryside and environmental designations and land management schemes. MAGIC has brought together information from all the partners into a shared information resource to enable the joined-up delivery of rural policies. Each partner benefits by having access to the information from the other project partners and there is also a collective benefit in working from a definitive and consistent information resource.

Typically, in the past, each organisation held their own data and there were some informal arrangements between organisations to share data. However, there was no single source of this information that resulted in a lack of consistency in datasets. In particular inconsistency arose where several organisations had each created their own version of a digital dataset from paper maps.

MAGIC has been created to provide an interface where datasets from the different organisations can be viewed together to allow fully informed decision-making, for example double-funding issues can be highlighted where one piece of land could be in different schemes run by two or more of the partner organisations.

On a simple level, MAGIC also increases awareness of the large amount of information that has been captured is available to outside organisations.

There is also funding available to create definitive versions of datasets where they don't exist. It is hoped that boundaries of several national datasets can be digitised as part of the project.

## **1.2 Funding and Delivery of the Project**

MAGIC has been developed using funds from the Invest to Save budget and from DEFRA. Invest to Save is a centralised government budget created to encourage partnership working between government departments and to promote innovative and more efficient ways of working. The technical development was led by the DEFRA Rural Development Service Geographic Information Unit (RDS GI Unit) and the project team was made up of RDS GI Unit staff along with one team member who was seconded from the Office of the Deputy Prime Minister for the duration of the project development work. The Invest to Save funding was critical to the success of the project as it provided resources for the development of this new system while ensuring that the day-to-day work of the RDS GI Unit was not under-resourced.

The project funding was originally set over a two-year fixed period, from April 2000 to March 2002. However, due to the outbreak of Foot and Mouth in the United Kingdom, and the resulting pressures on DEFRA's staff resources, the project and the funding has been extended into a third year. At the end of this year, MAGIC will then be maintained and developed by DEFRA on behalf of the partner organisations.

## **1.3 Web-based GIS**

The focus of the MAGIC project is the web-based GIS, or "Interactive Map". Suitable software had to be selected to provide this GIS functionality. Most GIS vendors offer web-based software solutions that can be customised to meet the customers' needs. A number of products available at the time of purchase were considered. As each of the MAGIC partners use different hardware and software systems, it was particularly important to find a cross-platform solution that didn't use technologies that would be blocked by some of the partner organisations' firewalls, for example, Java Applets or ActiveX components.

The initial two-year timescale meant that it was important to find suitable software and begin development work as quickly as possible. Therefore one of the major factors influencing the choice of software was the existing skill base within the project team. Where different options offered similar functionality, this was used as a deciding factor and as a result of the evaluation exercise, ESRI's ArcIMS software was selected because it fully satisfied the necessary criteria and the programming languages and technologies used within ArcIMS were familiar to the project developers.

The interface for MAGIC was designed using the ArcIMS HTML Viewer, which involves a "thick server" and "thin client". GIS operations are carried out on the server while the client interface is built using a combination of JavaScript and Dynamic HTML.

The map is simply an image created on the server and displayed in the client browser and no vector data is delivered over the Internet. This avoided the need for a plug-in or a downloadable program and made the Interactive Map available to anyone with a recent and freely available version of Microsoft Internet Explorer or Netscape Navigator browser. The drawback of this approach is that there has to be more communication between the client and the server as the client is limited to the JavaScript and Dynamic HTML functionality supported by the browser software.

ESRI's ArcSDE software was also purchased along with Microsoft SQL Server so that a database management system could be employed. In terms of data management, the database provides a number of management tools, security, backup and recovery facilities. Using ArcSDE in conjunction with the database provides the required spatial functionality. ArcSDE also provides the means for large datasets to be delivered through MAGIC and also offers more control in terms of performance times.

#### **1.4 Technical Architecture**

Users from all partner organisations needed straightforward access to MAGIC. One possibility that initially appeared to be the most desirable solution was to host the site as part of the UK Government Secure Intranet (GSI), which provides secure mail and web services for central government departments and agencies.

However, this had to be ruled out as not all partner organisations were connected to the GSI at the time. Budget constraints ruled out external hosting by a commercial company, and so it was decided to purchase a dedicated Internet connection and dedicated servers, both located in the DEFRA offices and managed by members of the project team and DEFRA IT staff.

One major advantage of this approach over using GSI is that the system isn't restricted to Government departments and that no-one is excluded from viewing the data as long as they have an Internet connection and one of the recommended and freely available browsers. A decision was made that apart from in the user-testing phases, there shouldn't be any access restrictions placed on the site, although publicising the site would at first be restricted to partner organisations and other interested organisations rather than the general public.

Another advantage of hosting the servers locally was that developers had direct access to the servers and control over installation of the application and any updates. This was particularly important during the user-testing phase as the prototype could be changed readily in response to feedback.

However, there are also disadvantages to this approach, for example, there weren't any existing security measures, backup routines or disaster recovery plans in place and there was no guaranteed "out-of-hours" support. Although making MAGIC available over the Internet was considered the most pragmatic solution at the time, it is not necessarily the most viable long-term solution and will be reviewed in due course.

## 1.5 Development Methods

As MAGIC is a partnership project, it was vital for the success of the project to produce an application that met the varying needs of users from all partner organisations. To develop such a solution, the development team applied techniques from the Dynamic Systems Development Methodology (DSDM)<sup>1</sup>. DSDM can be applied where the requirements of the project are flexible over time, working with a given project resource and timescale. The requirements of the project are continually reviewed as the project progresses by actively involving users and consulting with them wherever possible. It was felt that including the users in this way would not only improve the chances of success of the project, but also promote and encourage joined up working between the various government departments.

In order to work in this way, a user group was formed with representatives from all partner organisations, led by a user manager who was part of the project team. The project team felt it was essential to involve users with varying degrees of experience of using GIS or Internet technologies so that the system could be built to meet the needs of the full range of users, from the novice up to the experienced GIS professional. Setting up the group was by no means a straightforward task as it placed a great demand on the users' time (particularly on those users from other organisations who had no additional budget allocations to work on the project).

As the Interactive Map uses technology that wouldn't have been familiar to all user-testers, the first stage of development was to build a simple prototype site to show the type of functionality that could be delivered. The prototype site consisted of a customised version of the ArcIMS software, showing standard GI tools and functions and some additional functions, typically used in the partners' in-house GIS applications. This initial design was based largely on the thoughts of the development team and on previous applications that had been built.

The prototype was made available in June 2001, in a password-controlled part of the MAGIC website. Over eighty users were registered initially, but at the end of the user testing phase over two hundred users had been registered, many of whom found that MAGIC became an important tool in their day-to-day working. The final list of registered users not only represented all partner organisations, but also other interested parties including the National Biodiversity Network and Ordnance Survey who had requested access to the prototype site.

A structured questionnaire was distributed to the registered users to collect their feedback. Feedback was also received via the MAGIC e-mail address (published on the website), word-of-mouth and from other audiences who were shown the prototype site. During this user-testing phase, any bugs in the application were removed as soon as possible after notification and where suggestions for improvements could be implemented relatively quickly, this was also done as the testing continued.

## 1.6 Data

One of the most challenging parts of the MAGIC project was to identify and then assemble the key datasets for inclusion. It was established that the responsibility for a dataset would reside with the partner organisation that “owned” the data and that the partner would provide a copy of the dataset to be held on the MAGIC server. To enable the data collation process, “Data Representatives” were nominated from each of the partner organisations who were then responsible for the data provision from that organisation. To keep the data resource manageable, it was decided that MAGIC should only hold the current or most recent version of a dataset. Historical data would not be shown, nor would it be stored on the MAGIC servers.

As access restrictions were not planned for the live version of the Interactive Map, any dataset included in MAGIC would be available to the general public. This raised issues with sensitive datasets or with certain attributes of a dataset. Where sensitive information was present as an attribute of a dataset (for example, name and address details) this information was removed from the dataset prior to inclusion in MAGIC. However, in a small number of cases, a dataset wasn’t added to MAGIC because inclusion would have breached copyright or data protection laws.

From demonstrations of the application and user-testing exercises, many suggestions were made about which datasets should be included and in addition, a questionnaire was sent to members of the user group, asking them to prioritise datasets for inclusion or to suggest additional datasets. Some commonly requested datasets could not be provided, as the information for the whole of England couldn’t be collated. However, if a dataset was in-keeping with the aims and objectives of MAGIC and could be provided to the required standard, it was added to the application.

The MAGIC partners all had their own ways of collecting, structuring and managing datasets and the accompanying metadata for each dataset. Therefore, to ensure consistency of information, a MAGIC data standard or model was established for the management of the MAGIC datasets and their metadata.

Although there have been moves to create standards for geographic information in the UK, for example, the draft British Standard BS7975<sup>2</sup> which provides a basis for describing and referencing geographic information in the UK and the British Standard BS7666<sup>3</sup> which specifies a standard format for every property and street, there was no single existing data standard that could be directly applied to rural information. Therefore, a model that closely followed the two British Standards was created for MAGIC. This model consists of three elements. The first part is the data model that describes the geographic base, the second part covers the additional documentation that is necessary and the final part of the model concerns feature level information.

The model is a hierarchical and structured framework describing the rural datasets contained within MAGIC. It contains a geographic base containing six frameworks each based on a common theme. The geographic base is described as “Rural Designations and

Schemes” and the six frameworks it contains are: Joint Character Areas, Classifications of Countryside, Rural Designations, Rural Land-based Schemes, Administrative Areas and Habitat Inventories. Each dataset within MAGIC fits into one of the six frameworks.

Data, once collected was forwarded to the Data Manager and was quality checked before being entered into the MAGIC database. As each partner organisation had its own established procedures, providing the information to fit the data model involved a significant amount of effort from all data providers and as time progressed it became clear that not all the datasets identified for the live version would be provided in time for the launch. If a spatial dataset was ready for inclusion, but the full documentation hadn't been assembled in time, the dataset was added to MAGIC and the incomplete documentation was made available to users. Despite the time constraints, over 50 datasets were included in the launch version, with a plan to add further datasets at monthly intervals.

## **2 Developing and delivering the live version of the Interactive Map**

### **2.1 User Feedback**

During and after the user-testing exercise work continued on all parts of the project, aiming for a final launch date of Easter 2002. Only about thirty per cent of the users that were initially registered on the site returned the questionnaires that had been provided. However, those that had been able to return questionnaires provided a great deal of constructive feedback. In addition, feedback was also received from other sources and despite the low response rate of returned questionnaires, the overall set of feedback provided a vital resource for building the live version of the Interactive Map.

Users' opinions differed on minor points, but on the whole there was a general consensus about the functionality required for the live version of MAGIC. A major cause for concern was the fact that the datasets had been split into different categories or “map topics”. This had been done for two reasons, firstly to improve server performance and secondly to provide a clear map display as there were too many datasets to display at one time. However, the fact that datasets contained in different map topics could not be viewed together was extremely limiting for users. As a result of this, the Interactive Map was heavily customised to allow users to select their own subset of data to view at any one time. The option to also select a pre-defined map topic remained and the topics correspond to the data frameworks.

From the feedback it was also quite apparent that much of the terminology used on the Interactive Map, although familiar to the development team, was confusing or meant very little to many users. Users wanted a more intuitive interface where there was less room for confusion. On a positive note, users found that supporting information about individual features in a dataset was very beneficial. For example, in the prototype, attribute information for Sites of Special Scientific Interest included a link to its “citation document” containing detailed information about that site, which is required by many staff in the partner organisations. As a result, supporting information has been linked into the live version, wherever the information exists.

Where possible, the requests for additional functionality or changes to the existing functionality were implemented for the live version. Beta testing took place a month before the site launch, again involving representatives from all partner organisations. Around thirty users were nominated and after an initial meeting where the new site was introduced and the beta testing programme outlined, the beta-testers were asked to work through structured exercises and again complete a questionnaire. The response rate was much higher this time, with over eighty-five per cent of the beta-testers responding. Before the site went live, bugs and inconsistencies identified by the beta-testers were ironed out and the requested changes were made to terminology and functionality.

## **2.2 The MAGIC website**

The MAGIC website was also redesigned for the launch of the project. The live website contains information about the project and links to information resources. The documentation for each dataset is provided along with full online help for using the Interactive Map.

## **2.3 Launch of the Live Version**

The live site was launched in two stages. Firstly, in May 2002, the site was made live on the Internet and the data representatives and registered users were informed, but there was no formal announcement. This allowed performance of the site to be closely monitored before the official launch and wave of publicity in late July 2002. Between these two dates, problems caused by occasional instability of software were investigated and several updates were made to the datasets and to the Interactive Map functionality.

Since the launch of the website, feedback has been received both by word of mouth and through the feedback facilities on the MAGIC website. Although there have been some small problems that have required attention, much praise has been received and the overwhelming message has been one of satisfaction with the site and that it is proving to be a very useful resource.

## **3 Lessons learnt**

- MAGIC has proved that with commitment and enthusiasm from the involved organisations, joined-up government can work. Already, MAGIC partners are discussing future projects and all partners now have a much better knowledge of the work carried out by the other organisations. We now need to build on this work to ensure future developments are carried out with other departments' activities in mind, working together or simply keeping each other up to date so that work isn't duplicated and savings are made wherever possible.
- The Invest to Save funding was crucial to the success of the project as it provided the budget for additional staff resources for the project team. However, the users and data representatives from other organisations have had to provide significant input, without any extra funding. This has placed a lot of pressure on the partners and the

project team. In future it may be necessary to ensure that funds are made available to the partner organisations to carry out this work.

- Similarly, in terms of the user testing exercise, a considerable amount of time was required from all users. The initial response rate would imply that not all users who originally put themselves forward for the role were able to carry out the user testing. With hindsight, and the knowledge that a one hundred per cent response rate is most unlikely, more users could be sought to take part in the testing period. Alternatively, as the beta testing exercise was much more successful in terms of user involvement, it may be more productive to set up smaller more closely managed groups who are asked to carry out testing over shorter time periods.
- Despite the low response level, the feedback received was vital to the success of the project. As a result of the users' feedback, the prototype site was completely redesigned to give users a more intuitive interface and the functionality they required. Without this input and the flexible approach taken by the project team it is unlikely that the application would be as widely used as it is. Most functions were changed in some way in response to users' feedback. In addition, taking this approach where users from the different organisations can see the implementation of their suggestions will hopefully have given those users a sense of ownership and involvement in the project, and encourage use of the site.
- Linking to information available on other Internet sites has greatly enhanced the MAGIC site. For example, links are included to the Sites of Special Scientific Interest citations on the English Nature website<sup>4</sup> and the Special Areas for Conservation (SACs) information on the Joint Nature Conservation Committee (JNCC) website<sup>5</sup>. The JNCC website also includes a link from the individual SAC pages back to a boundary of that SAC in MAGIC. These simple links, which require very little in terms of development have added value to both sites and in many cases have opened up new avenues of communication between departments.
- In terms of gathering the datasets, this is likely to be the biggest ongoing challenge. Many of the datasets included in the application are continually updated by the originating organisation, and it is vital that the version in MAGIC is the most recent. There is inevitably going to be a small time lag as data is transferred from the originating organisation to the project team and quality checked before being input into MAGIC, but it is important to minimise this time lag as much as is possible. It is essential that the various organisations and government departments build on the work carried out for MAGIC and work together in terms of data collation and coordinate publication of datasets to other organisations and the general public.
- One other requirement that has been identified by many people is the extension of MAGIC to the rest of the United Kingdom as it covers only England. This is a particular issue for those organisations working with UK wide designations. The project team is addressing this and so far two seminars have taken place with colleagues from Scotland, Wales and Northern Ireland to discuss the issues involved.

As there are devolved administrations, this is not straightforward, but it's hoped that some progress can be made by working together.

#### **4 What next?**

Funding for the project runs up until the end of March 2003 and there are specific activities planned for this final year of the project. In terms of data, digitising work is being carried out to create definitive versions of several datasets. The website itself will be developed to provide additional resources apart from the Interactive Map. Feedback to the site has already made it clear that many people require the spatial datasets to use in their own projects and their own GIS applications. Some of the partners have already provided access to many of their datasets, for example English Nature provide a download area on their website. Where there aren't any existing measures in place it is hoped that they can be made available on the MAGIC website. This will involve additional data protection and copyright issues, but it's hoped these can be resolved as the need for this facility has been highlighted by many users.

The Interactive Map will be developed in response to user feedback, along with several planned additions. A major focus of the work will be on collaboration with organisations outside the MAGIC partnership to discover whether it's possible to establish interoperability between MAGIC and other web-based systems. For example, can a request be sent from one website to another without the user actually being directed to the other website? Building in this type of process could enrich a number of sites without having to duplicate data resources and functionality on the different sites. If this proves possible, it will be implemented using OpenGIS standards so that the work can be extended to sites regardless of the technology and software used.

#### **Conclusions**

MAGIC has so far been warmly received and it is now important to ensure that the datasets are current and that the Interactive Map and the website are updated regularly. This is going to be more challenging when the Invest to Save funding ends after March 2003, but DEFRA is providing future funding and all partners are committed to the development and upkeep of MAGIC.

MAGIC has provided lessons for joint working and has shown that organisations can support each other in a variety of ways. It is hoped that we can build on these lessons, continue to develop links and partnerships and embark on similar joint projects in future.

## References

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<sup>1</sup> <http://www.dsdm.org>

<sup>2</sup> Draft: BS 7975:2000 Definition of Geographic Bases for use in the United Kingdom and methods for their creation and maintenance. British Standards Institute 2000.

<sup>3</sup> [http://www.nlpg.org.uk/\\_public/sheet8.htm](http://www.nlpg.org.uk/_public/sheet8.htm)

<sup>4</sup> <http://www.english-nature.org.uk>

<sup>5</sup> <http://www.jncc.gov.uk>