

2012 年度学術交流支援資金・電子教材報告書

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1. Introduction

1.1 Geographic Information System (GIS)

There are many definitions for GIS. In the simplest terms, GIS is the merging of cartography, statistical analysis, and database technology. Many have expressed that GIS integrates hardware, software, and data for capturing, managing, analyzing and publishing all forms of geographically referenced information. Still others have said that GIS is a technological field that incorporates geographical features with tabular data in order to map, analyze, and assess real-world problems.

1.2 ArcGIS

ArcGIS is a GIS for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database. ArcGIS provides an infrastructure for implementing GIS for a single user or for many users on desktops throughout an organization, across a community, and openly on the Web.

ArcGIS are a very powerful tool for environmental studies and many other applications. For example, we can use them to map our land use change time serially; we can create a topographic map of a town based on the property values. All spatial information could be visualized in a map by using ArcGIS which can explain what our world is without thousands and thousands of words, not only a bunch of data inside table. However, there are some disadvantages of ArcGIS. They are: 1) it requires an enormous amount of data inputs to be practical for some tasks, the more data that is put in, the more likely that there will be errors either in the meta data or in the location of the data points. Since it takes many maps to gather different types of data there is often discrepancies from one map to another; 2) the GIS software is quiet expensive that it couldn't bear such amount money for personal use. Nowadays there are some development of open source GIS such as GRASS GIS that able to overcome this problem; 3) although there are some free software, it is also difficult for beginner to use.

In consideration of above mentioned issues, ArcGIS.com online is a better choice for people who are interested in GIS without experiences using specific software. It is not only for free of charge, but also it is easier to operate and friendly graphical interface.

1.3 ArcGIS.com Online

ArcGIS.com Online is a cloud-based, collaborative content management system for maps, apps, data,

and other geospatial information. With ArcGIS Online, you can quickly create interactive maps and custom apps, and then publish and share them in Esri's secure cloud. You can share content through groups with members of your organization, keep it private, or make it public. You stay in control of your data, lower your IT costs, and empower your users and customers with easy-to-use, web-enabled content. Organizations will be able to evaluate and purchase a subscription for an ArcGIS Online organizational account in 2nd quarter of 2012.

1.3.1 Online service

ArcGIS Online is available to manage your organization's geospatial content in a secure environment, to publish maps and data as hosted services in Esri's cloud, to create maps and applications, to customize the ArcGIS Online home page, and to collaborate across the organization. All ArcGIS Online services fall under the Web Services and API Terms of Use (E-800). These terms of use are referenced from the Esri Master License Agreement.

1.3.2 Server

ArcGIS Server can be deployed in the Cloud via the Amazon Elastic Compute Cloud (EC2) so that organizations and developers can publish and quickly deploy custom GIS mapping applications within minutes.

1.3.3 SaaS

GIS Software as a Service (SaaS) comprises end-user applications delivered as a service rather than as traditional, on-premises software. SaaS provides focused, Cloud-based clients and applications that easily solve complex business problems using GIS tools and data but don't require GIS expertise to use. The most commonly referenced example of SaaS is Salesforce.com, which provides a customer relationship management (CRM) system accessible via the Internet.

1.3.4 Mobile

Mobile GIS services help organizations deliver GIS capabilities and data from centralized servers to a range of mobile devices. You can use ArcGIS for Windows Mobile to deploy intuitive and productive mobile GIS applications to increase the accuracy and improve the currency of GIS data across your organization. Easy-to-use ArcGIS for Windows Mobile applications enable field staffs who do not necessarily have any GIS experience such as mapping, spatial query, and GIS editing, etc.

1.4 GIS Cloud

GIS Cloud is a software platform that allows you efficiently and with great ease implement that GIS technology has to offer (see Figure 1). GIS Cloud is the purely web based GIS powered by cloud computing. Cloud computing is rapidly emerging as a technology almost every industry that

provides or consumes software, hardware, and infrastructure can leverage. The technology and architecture that cloud service and deployment models offer are a key area of research and development for GIS technology. There are several types of cloud computing deployment scenarios such as public cloud and private cloud.

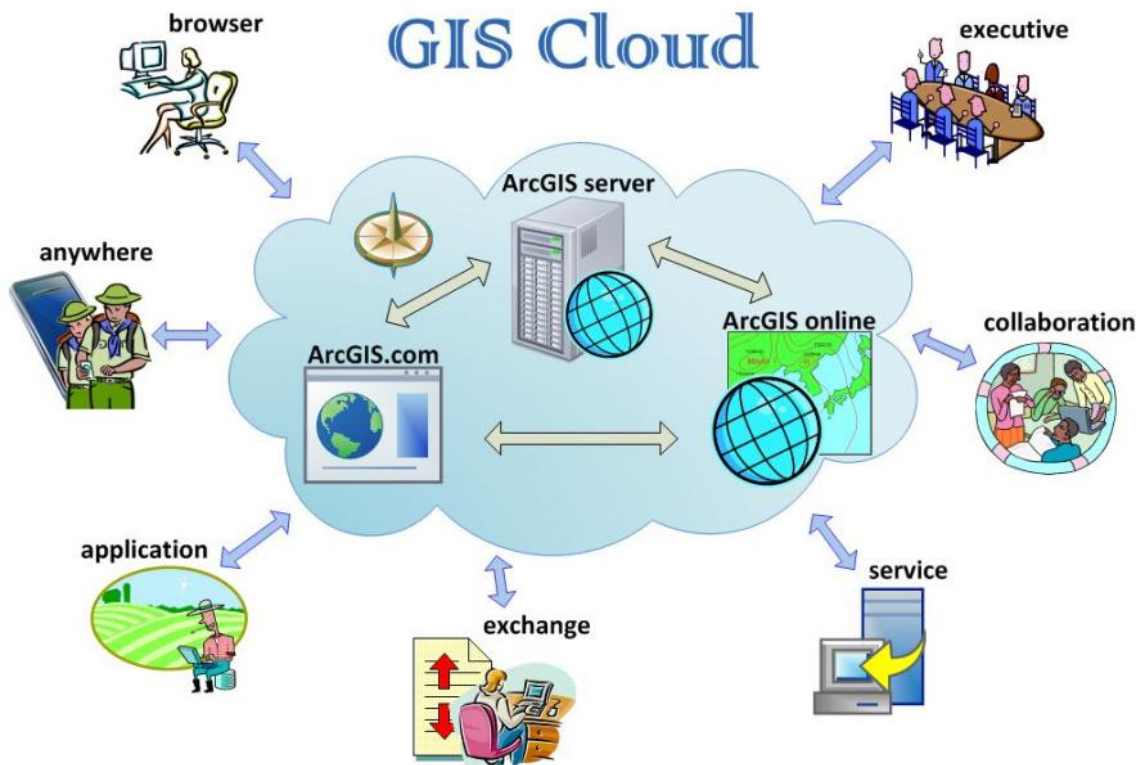


Figure 1 Working flowchart of cloud GIS

GIS Cloud provides full desktop GIS features enriched through the website. It offers easy and efficient visualization, analysis and exploration of geographic information. The primary goals of the GIS Cloud platform are to simplify exchange of geographical information between users, and to offer an easy way to analyze the information regardless of the location of its users. By using GIS Cloud, users access the full power of desktop GIS, allowing for such activities as geospatial analysis, spatial intelligence, the creation of customized mapping reports, and publishing geographic analysis on the Web.

1.5 Current Status of GIS Cloud

Since there are more advantages of GIS Cloud use, such as no need to setup GIS infrastructure, easily access to through the browser, edit and publish online immediately, etc., it has becoming a trend that GIS Cloud would be widely used in the world in the different field of application. For instance, there was a project titled Common Market for Eastern and Southern Africa, which was comprises of 19 member states spanning Northern, Eastern and Southern Africa in 2011, using GIS Cloud technique to develop transport infrastructure network. The project delivered excellent

technical services to member states for the advancement of sustainable growth and development through regional integration.

Nowadays, there are two major matured ArcGIS cloud system in a market of the world. One is developed by ESRI company (<http://www.esri.com/software/arcgis/arcgisonline>), the other is GIS Cloud Ltd. (<http://www.giscloud.com/apps/map-editor>). For ESRI, there are several different types of base maps supply, but only 30-day free trial. For GIS Cloud Ltd., although it is free for Non-commercial use, no base map could be supplied so far.

2. Class design with ArcGIS.com

This course is designed for graduate students with no GIS background or experience who are interested in basic features of ArcGIS and geographic information systems in general. This course focuses on creating layers and map symbology, editing spatial and attribute data, displaying cartographic, spatial analysis, etc. A portion of the course is reserved for carrying out an analysis project and applying many of the new skills and techniques learned in this course. Participants conduct queries, perform spatial analysis, and present their results in a hard-copy map.

Goals:

- Understand what a ArcGIS.com is
- Query a GIS database to gain information and locate features
- Manage geographic data
- Perform spatial analysis
- Edit spatial and attribute data
- Convert data from other formats
- Produce high-quality maps and reports
-

3. Content design

For new ArcGIS.com users who wish to utilize the key functions of the online system, this online ArcGIS course is a perfect introduction to ArcGIS and all of its constituent applications. The course includes information on loading spatial and attributes data, symbolising data, building attribute expressions, interactive spatial selection, dynamic label management and producing maps.

4. Data preparation

ArcGIS.com is open source to access to searching multiple data. Vector and raster data (.shp, .tif, .kml,...) are available for exercises. It contains in terms of landcover, landuse, population, etc. Students could explore and download data which they are interesting in or relevant to their research. Data could be downloaded from website (<http://www.arcgis.com/home>). Meanwhile, your data could be uploaded to the servers to share with others.

In this lecture, two dataset are prepared for student to do exercises. One is a landcover of Kesennuma city, the other is a population of Kesennuma city.

5. Applications development

We have developed several applications that you can easily access through your web browser, such as landcover changes and population density in Kesennuma city, landuse at SFC campus, etc. All applications are instantly available and users can get started with it in a matter of seconds. Everybody can sign up and explore all of our applications to see how you can use these applications to improve your workflow. No more IT, no more CD installation, no more desktop and server software.

6. Manual Editing

This manual will allow users easily to navigate through the Map Editor interface. The manual illustrates the functionality, options and methods that could satisfy user's requirement. On the Map tab, you can specify data content such as basemaps and operational layers. You can also set the data layer symbolization. On the Tools tab, you define functionality such as editing and selection tools that will be available in the web application. On the Layout tab, you can configure the application's look and feel by applying a custom logo, custom title, and colors and select from the prebuilt layout templates furnished. Any property changes will immediately be displayed in the main preview window.

6.1. Start with ArcGIS.com: sign up for an account

Type the website address (<http://www.arcgis.com/home/index.html>) to access to ArcGIS online (see Figure 2). Click *sign in*. If you do not have a user name, please first click *create an account* to register a new user. After create an account, you could sign to entry the ArcGIS online.

User name: sfcfs000

Password: student10

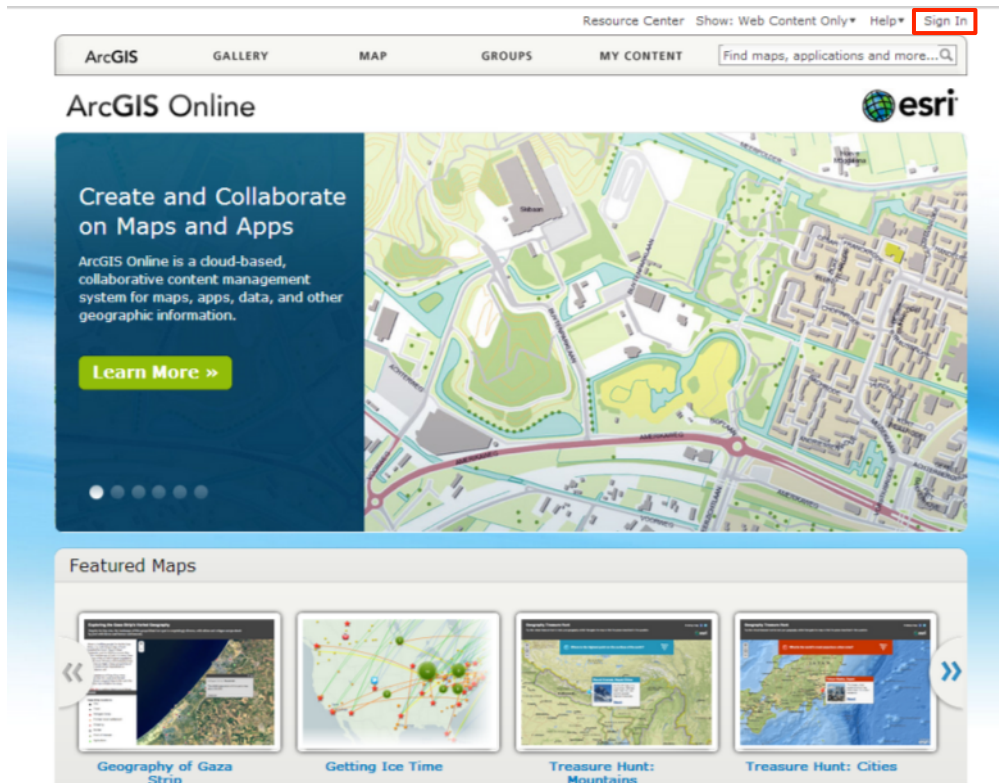


Figure 2 interface of ArcGIS Online

6.2. Introduction of ArcGIS Online

When you access to ArcGIS Online, the menu bar is given five buttons to explorer, discover, and create map through ArcGIS Online (see Figure 3). They are:

1. *GALLERY*: browse featured maps, web mapping applications, and mobile applications shared by the ArcGIS Online community.
2. *MAP*: build interactive web maps and share with others.
3. *GROUPS*: invite and collaborate with other ArcGIS Online users.
4. *MY CONTENT*: add and share your items with the ArcGIS Online community.
5. *SEARCH*: type keywords in the *Find maps, applications and more...* text box to find some theme topic that you are interested.



Figure 3 The menu bar of ArcGIS Online

6.2.1. GALLERY

From the menu bar of the ArcGIS.com home page, click *GALLERY* to open the map searching viewer. There are three catalogs of maps, it is Maps, Web Apps, and Mobile Apps (see Figure 4). A number of different classification map are contained in each catalog, such as forest, street, people living, world relief, etc.

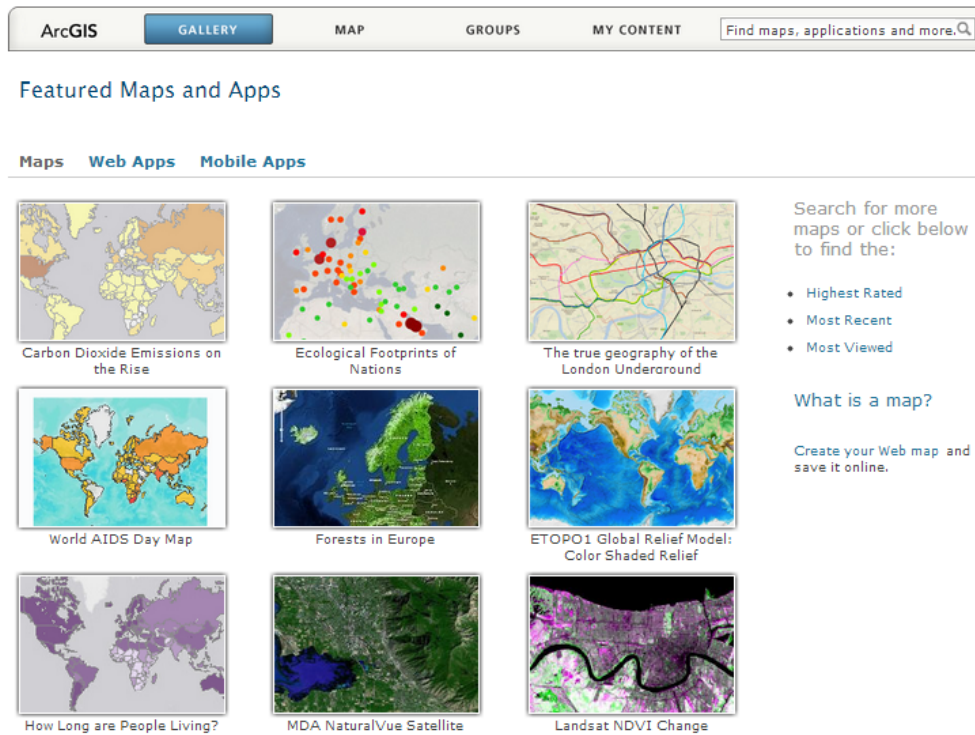


Figure 4 Gallery interface

6.2.2. MAP

6.2.2.1. Basemap

From the menu bar of the ArcGIS.com home page, click *MAP* to open the built-in map viewer that you could create a map (see Figure 5). By default, the basemap is the Topographic map from Esri. Click *Basemap* and select the map of your choice (Imagery, Streets, OpenStreetMap, Terrain, etc.). Here, we take “Imagery” as a basemap.

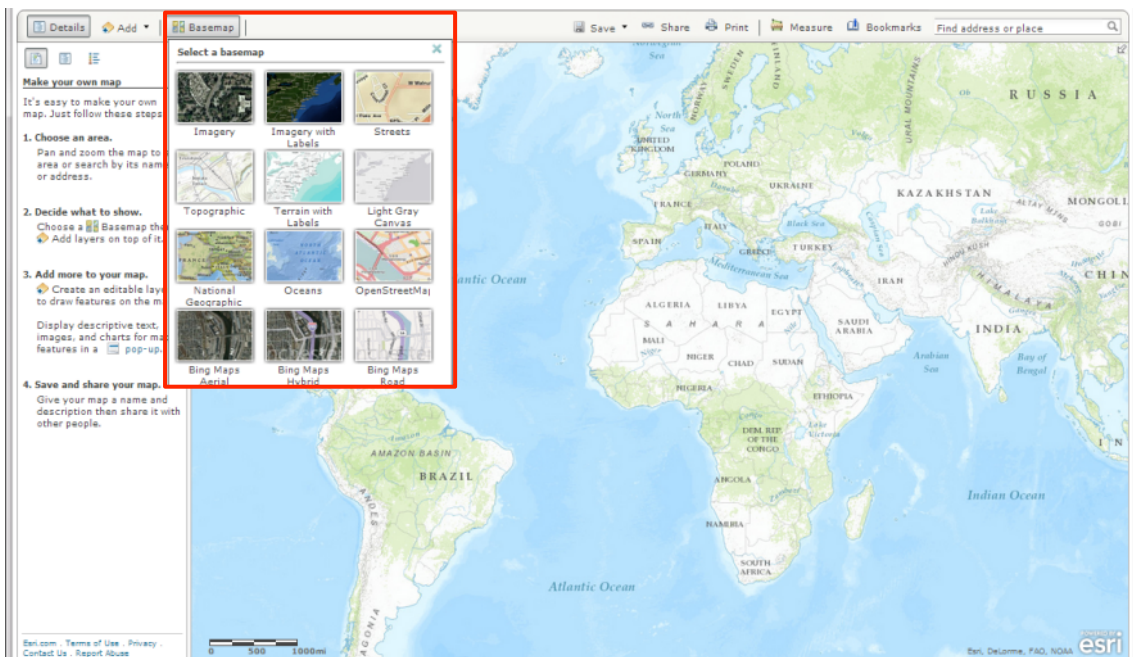


Figure 5 Map creation interface

6.2.2.2. Layers

There are four options for layer activities. They are *Search for Layers*, *Create Editable Layers*, *Add Layers from File*, *Add Layers from Web* (see Figure 6).

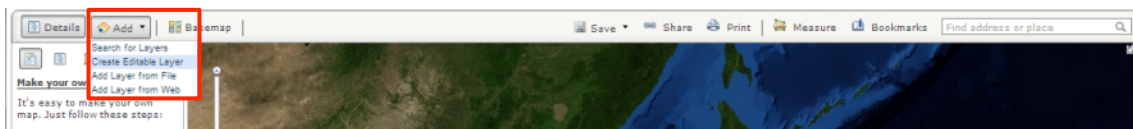


Figure 6 Drop down list of “Add”

To search for layers:

To click *Search for Layers*, type “japan population” in *Find* text box, click *Go* to search (see Figure 7, 8, 9, 10). The search results are shown at the left column. Select one of them, e.g., (2)社会資産:人口統計サービス(Population), click *Add to map*, click *Done Adding Layers*. Click *Item Details*, the detailed information of the layer will be shown in a small window.

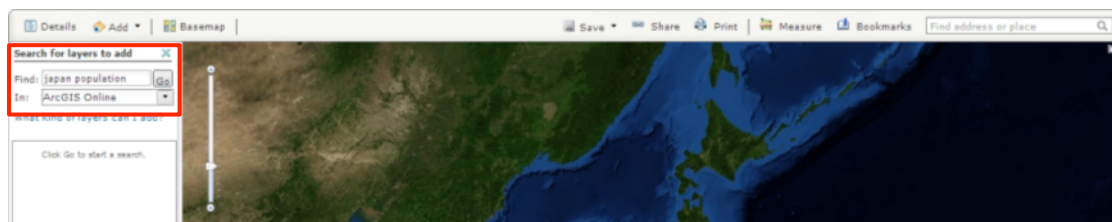


Figure 7 Interface of search for layers

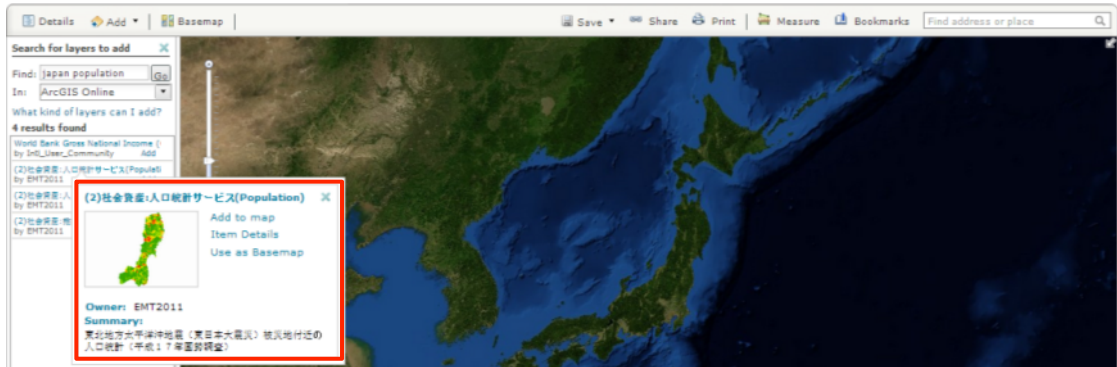


Figure 8 Search result

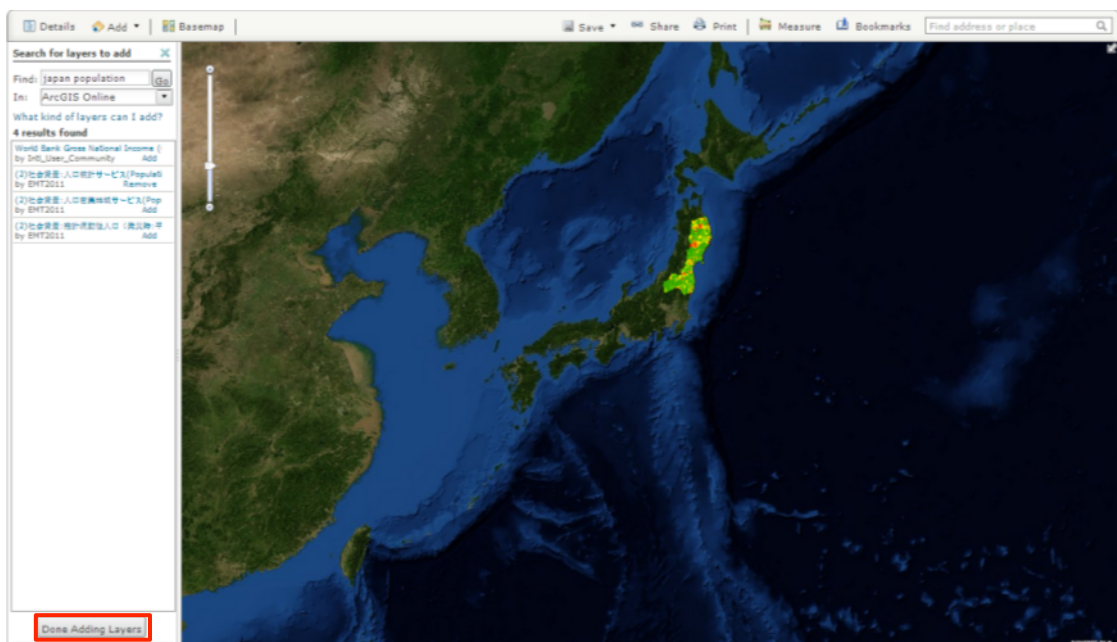


Figure 9 The Layer is added to the map

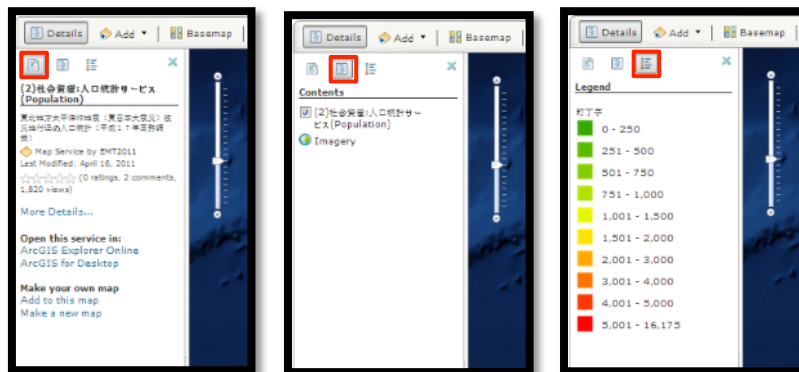


Figure 10 About this map (left), Show contents of map (middle), Show map legend (right)

To Create Editable Layers:

To click *Create Editable Layers*, type “SFC Campus” in *Name* text box (here, we take SFC Campus as an example), click *Creat* button (see Figure 11).

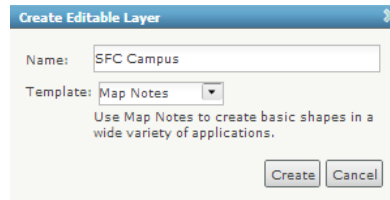


Figure 11 Window of Create Editable Layers

After created a layer, a new button named *Edit* is shown in the menu bar (See Figure 12). Features of *Points*, *Lines*, and *Areas* are listed in the *Add Features* on the left column. Try to type key words in *Find address or place* text box to search SFC campus.

© Hints: you can change your basemap.



Figure 12 Interface of editable layer

Click icon of *Area* in the *Areas* group (See Figure 13), click an object on the imagery to start drawing, press *CTRL* to enable snapping, click to continue drawing, double click to complete drawing.

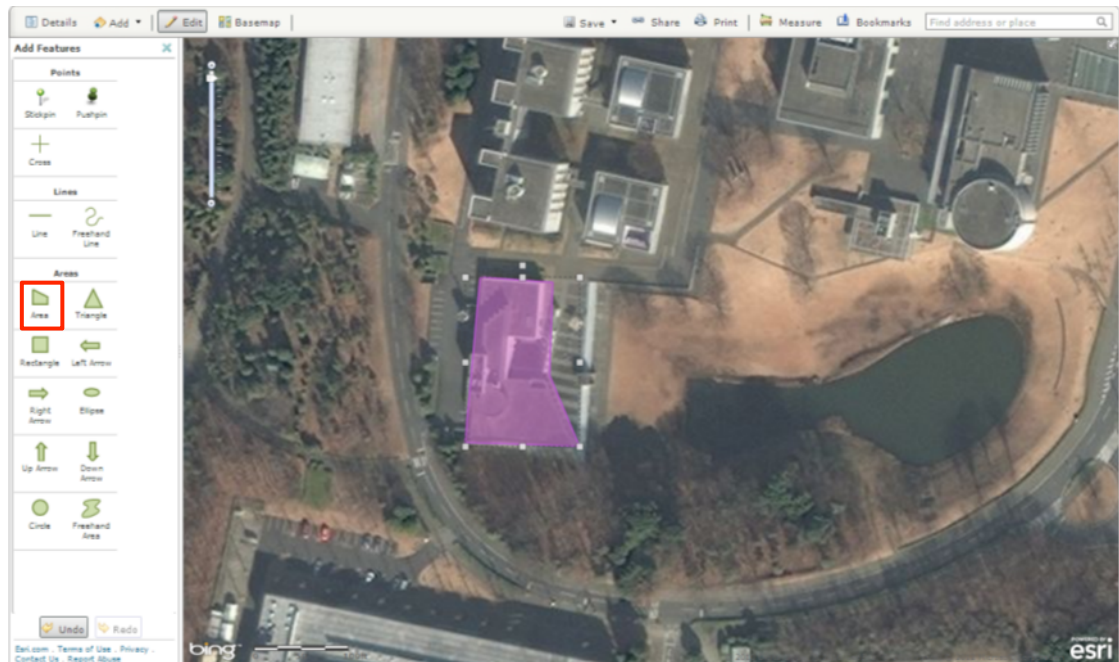


Figure 13 Interface of creating a layer

After finished the drawing, name the title and short description of the object. The symbol you drawn could be changed to different color (see Figure 14). Click *Change Symbol*, choose the color, click *Done*, then name the title and tags of the map, click *Save Map*.

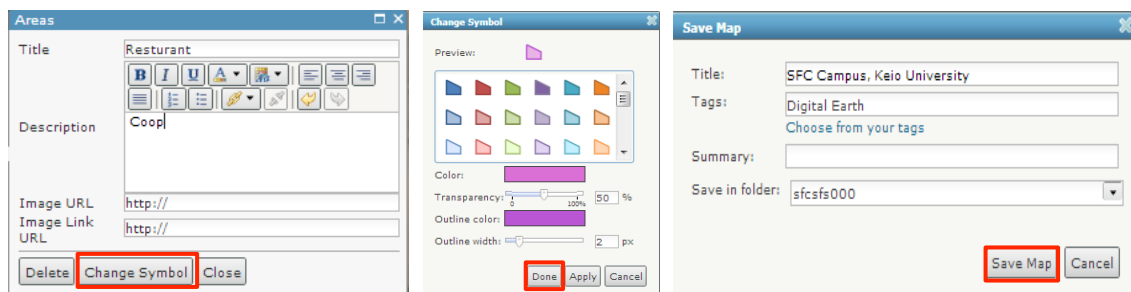


Figure 14 Name title (left), change color (middle), save map (right)

It is your turn now to try functions of each button, and finish to map the SFC campus (see Figure 15).

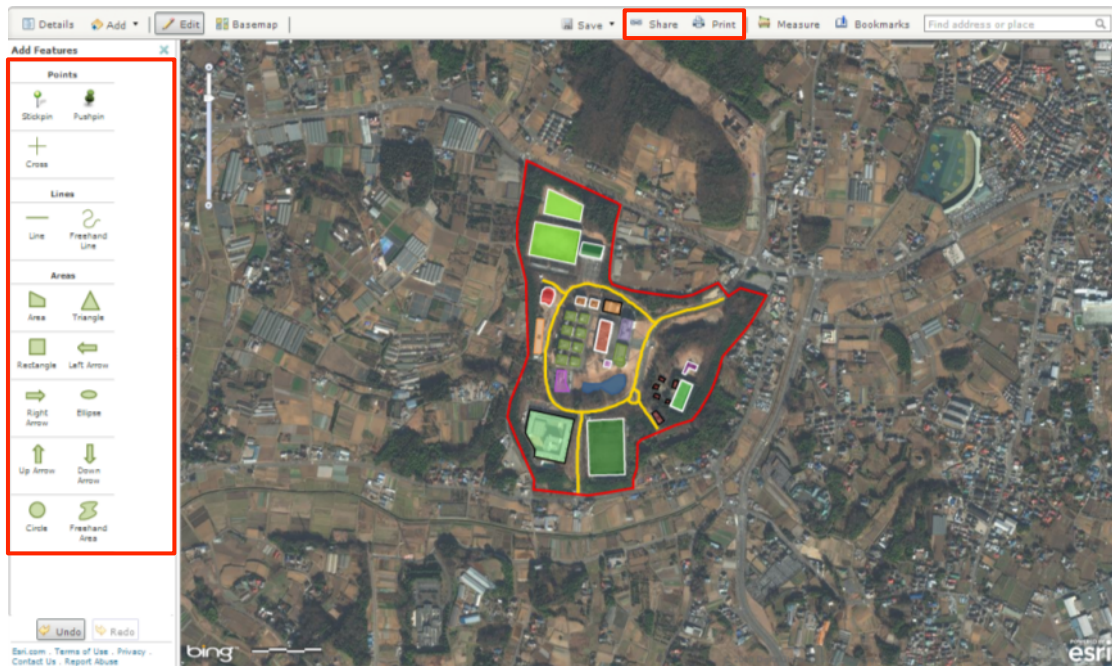


Figure 15 Map of SFC campus

6.2.2.3. Share and Print

To share or publish data, click share, choose who can view this map (see Figure 16). If you want to share your data with everyone, tick *Everyone (public)*; if you want to share your data with specific users, you should create a group at the beginning. See 6.2.3 section how to create a group. These can be accessed by web, desktop, and mobile applications anywhere through the internet. You can choose to share these hosted services with everyone or keep them private.

Click *Print*, the map you create will be shown in new webpage. The map includes the map title, layers, and copyrights.



Figure 16 Interface of sharing option (left), output of the map (right)

6.2.2.4. Measure

To measure area or distance, click *Measure* (see Figure 17). In the drop down list, click *Area* (left), *Distance* (middle), and *Location* (right) to measure objects in the map. The unit of area is optional including Acres, Sq.Miles, Sq.Kilometers, Hectares, Sq.Yards, Sq.Feet, and Sq.meters. The unit of distance includes Miles, Kilometers, Feet, Meters, and Yards. The unit of location includes Degrees and DMS.



Figure 17 Interface of Measure

6.2.2.5. Bookmarks

To add bookmark, click *Bookmarks* (see Figure 18). Click *Add Bookmark*, type your content in the text box.

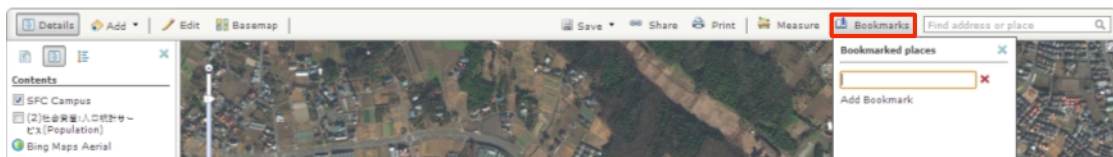


Figure 18 Add bookmark

6.2.3. GROUPS

You'll be able to invite specific users or groups of users who already established logins to share your dataset. Click *GROUPS* in the main menu bar, click *Create a Group* (see Figure 19). After created a group, users who belong to the group could be invited by you; or you could be invited by other users who own the other groups. All groups are listed in *All My Groups*.

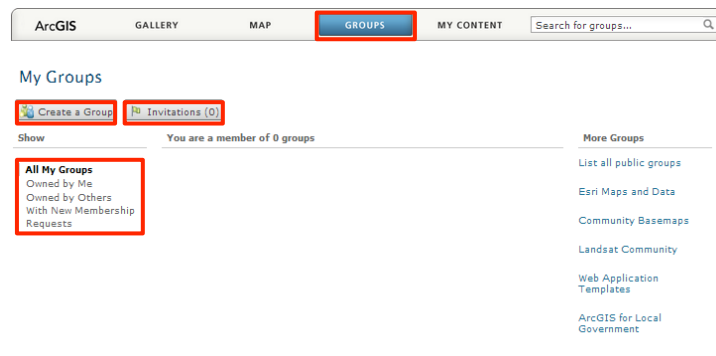


Figure 19 Interface of creating a group

Sharing maps and other information using groups where you can communicate information, designs, and other ideas. You can also create destinations for your users and customers with ready-to-use templates. You can share your information publicly, or keep it private.

6.2.4. MY CONTENT

Click *MY CONTENT*, all your files and their properties are shown in the “My Content” page (see Figure 20). It presents each file’s title name, data type, date of modification, sharing status, and file’s size. You can create a new folder or delete a folder by clicking *New* or *Delete* on the left column; or on the right column, click *Add Item*, *Create Map*, *Share*, *Delete*, and *Move* to add a new item, quickly create a map, share your data with others, delete a map from the list, and move a map to another folder, respectively.

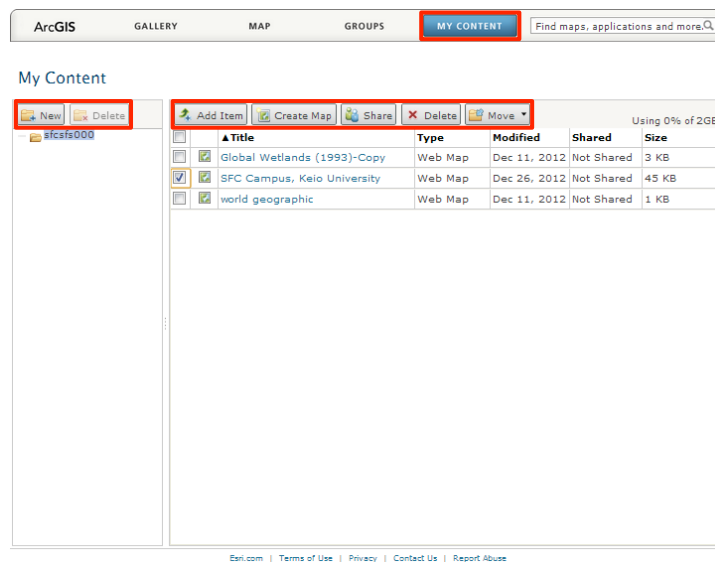


Figure 20 Interface of MY CONTENT

Questions:

1. What is a basemap used in your map? And why you select the basemap?
2. How did you find the SFC campus?
3. Is it easy to read the map?
4. Which feature is used to label buildings?
5. Which feature is used to label roads?
6. Which feature is used to label a pond?
7. Which feature is used to label the boundary of SFC campus?
8. What does the top right window function (see Figure 21)?

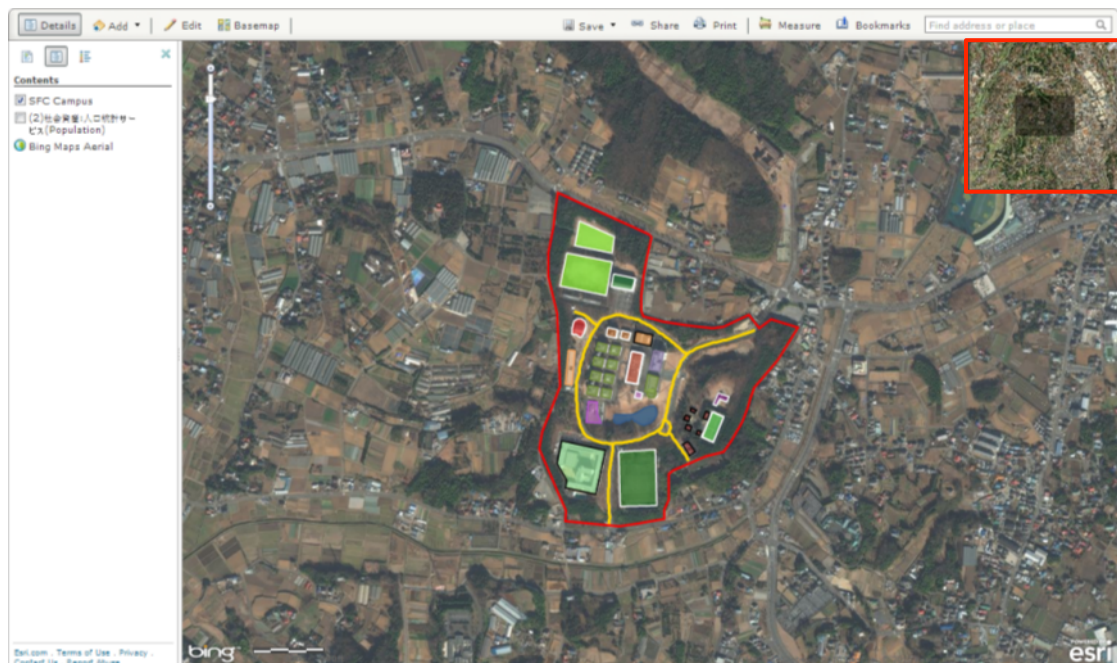


Figure 21 Show map overview

7. Manual testing

This session is focused on testing developed application and its approach. Certainly, we are going to participate in a project that followed the development approach, but rather than focusing on the manual only. Thus, the session focuses on the discipline and extensive testing efforts that are required to support digital earth science!

8. Comparison with conventional courses

ArcGIS Online allows users and organizations to extend GIS beyond its traditional reach. It makes anyone can do to find and use data in ArcGIS Online, build and share maps with others, and incorporate ArcGIS Online into your organization's GIS workflow. Compare to the conventional GIS courses, ArcGIS online presents premium advantages:

1. Access, share, and manage content
 - Browse maps, apps, and data
 - Access basemaps, image services, and Bing Maps
 - Access maps from browsers, mobile devices, ArcGIS for Desktop
 - Embed maps in web pages, blogs, applications
 - Create groups and share items with groups

- Keep content private, share it publicly, or within groups
- 2. Add your own data to maps
- 3. Add Geometry Service to maps & apps
- 4. Store maps, apps, and data in Esri's cloud
- 5. Add World Geocoding Service to maps & apps
- 6. Access ArcGIS Portal and Web Mapping APIs
- 7. Publish hosted services in Esri's cloud
- 8. Manage user roles, access, and security
- 9. Monitor usage information
- 10. Add your organization's logo and banner to your ArcGIS Online homepage
- 11. Display your organization's maps on your ArcGIS Online homepage
- 12. Create a custom URL for your ArcGIS Online homepage
- 13. Includes Technical Support

9. Improvement

We will configure our own application templates and simple media templates such as map viewer and mobile web. The templates can be downloaded or used as hosted applications via your ArcGIS Online account.

10. Web publishing

ArcGIS Online is a rapidly advancing cloud-based system for creating and sharing maps and geographic information. It could enable anyone to create, view, and use intelligent maps. Users can also upload and style geographic data, create web maps, and embed maps into websites to be published.

After we finish applications on our research domain, the productive outcome will be uploaded and readily available to a wider audience through the open, scalable worldwide. Anyone can use it, no programming needed!