NATURAL RESOURCES ATLAS OF SOUTHERN GUAM

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http://www.hydroguam.net

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The Natural Resources Atlas of Southern Guam is a reference and an educational tool that provides a comprehensive picture of the natural resources found within the fourteen southern Guam watersheds. The Atlas was inspired and initiated by the need for up-to-date information required for sustainable development and protection of Guam’s watersheds, and was originally envisioned as a “Watershed Atlas of Southern Guam”. Over the course of its development the Atlas outgrew its original scope and got to include a wealth of information related to a wider range of natural resources and came to be called “Natural Resources Atlas of Southern Guam”. Nevertheless, the concern for the protection of watersheds remains the focal point of the Atlas. This is clearly reflected in its watershed-by-watershed approach, in which every portion of the Atlas deals not only with southern Guam as a whole, but also with each of the 14 southern watersheds individually.

The digital version of the Natural Resources Atlas of Southern Guam is designed as a comprehensive and user-friendly web-based information server. It is freely accessible on the Internet at www.hydroguam.net address and offers a wide range of textual, graphical, statistical, and geographic information to any interested user. It allows advanced operations such as viewing and manipulation of GIS data yet requires no special programs or browser plug-ins to be installed by the user in addition to the standard web browsing software. It is the foundation and an integral part of a planned series of products dedicated to dissemination of information and raising of awareness regarding the diversity, current state, sustainable use, and critical threats to natural features of southern Guam. In addition to the digital version of the Atlas, we plan to create a print version and other educational materials in the near future.

**KEY FEATURES**

The key features of the Atlas are:

- Digital accessibility - the Atlas in its entirety is a digital creation and is permanently available on the Internet.
- Dedicated Internet domain - the Atlas is available at a specially created Internet address: www.hydroguam.net.
- Attractive design - eye-catching design, aesthetically pleasing and consistent color schemes, quality programming and excellent color graphics make the Atlas pleasing to use and explore.
- User-friendly interface - the Atlas is inherently easy to use thanks to a logical series of menus and sub-menus that stay fixed on the periphery of every page while their dynamic central parts change per user requests.
Easily updatable - owing to its digital format and modular structure, any current part of the Atlas can be modified at any time, and any future part can be added at any time.

Rich content - the Atlas contains nearly 1,000 individual pages offering a wealth of textual, graphical, numerical, geospatial, and other information related to natural resources of southern Guam.

- Textual information – informative texts about different types of southern Guam’s natural resources, educational and introductory materials, glossary of terms, user guides, etc.
- Graphical information – educational diagrams, sketches, photographs, etc.
- Numerical information – raw data, spreadsheets, charts, etc.
- Geospatial information – image maps (JPEG), GIS data, KML data, etc.

Download options - much of the material offered in the Atlas, including hundreds of images, pre-formatted maps, documents, PDF files, spreadsheets, and raw data are available for download.

Full GIS and Google Earth integration - geospatial information served in the Atlas is accessible to users in GIS and Google Earth file formats thus offering a virtually unlimited range of applications.

DIGITAL ACCESSIBILITY

The Atlas in its current form is completely digital. It resides on a high-speed and reliable web server. All the web pages comprising the Atlas are publicly available and their viewing requires no registration or filling of forms and has no access restrictions. The Atlas is in entirety indexed by Google and other major search engines and is thus searchable and easily accessible. The Atlas offers numerous advanced features yet requires no special software or browser plug-ins to be installed by the user. All that is required is an Internet connection and standard web browsing software. The Atlas works with any commonly used operating system and web browsing software.

DEDICATED INTERNET DOMAIN

The Atlas is accessed via a dedicated domain name. As such, it is perceived by users as a stand-alone, self-contained, and comprehensive product, as opposed to merely a series of pages on an already existing website. The domain name was selected in order to be intuitive and easily remembered and reads: www.hydroguam.net. Any Internet user can thus access the Atlas not only via standard search engines or links on existing Internet pages, but by simply typing the dedicated domain name in any web browser address bar, without having to remember any complicated addresses involving slashes (/) and page names (index.html, etc.).

ATTRACTIVE DESIGN

Every page of the Atlas is designed in a consistent fashion, including a fixed layout, attractive color schemes, characteristic fonts, and unvarying appearance. This allows the users to experience it as a well-integrated product whose every page and portion is clearly part of the same “brand”. Every page is identified by a banner-type graphic that bears the name “Natural Resources Atlas of Southern Guam” and stays fixed at the top of the screen. Next to the banner on the top right hand side of the screen is a small space dedicated to changing color photographs.
which showcase the natural beauty of Guam. A new photo is displayed at every re-loading of a page or opening of a new page, and is randomly selected from hundreds of high-quality color images. Below the banner and the space filled with randomly changing images is the main part of the screen. It consists of a stationary series of menus and sub-menus that stay in peripheral parts of the screen and offer quick, logical and practical gateway to information which is always displayed in the dynamic central part of the screen.
USER-FRIENDLY INTERFACE

User interface of the Atlas is formatted in a consistent and convenient way that makes it inherently easy to use and requires virtually no time getting used to. The various menu and sub-menu options are available via navigation bars found found at the top, bottom, left, and right hand sides of the screen. The left and right hand size menu bars are most extensive and important: the left links to pages with mostly textual information, and the right leads to pages with mostly geospatial information. The menus are organized logically and hierarchically and stay fixed no matter what page or information the user is viewing in the dynamic portion of the screen. The fact that navigation menus are stationary and identical on every page make it possible for user to jump to any page available directly from any other page, without spending time to browse. This is an especially advantageous feature considering that the wealth of information offered by the Atlas is presented via nearly 1,000 individual pages, which would otherwise be difficult to locate.

EASILY UPDATABLE

The pages in the Atlas were created using PHP software technology which allows easy updates of hundreds of pages simultaneously. Any change whatsoever to the content of the Atlas is easily implemented and immediately effective. The Webmaster accesses the server hosting the Atlas via File Transfer Protocol (FTP) connection, download the page or part of the website that requires change, makes the change on local machine, and uploads the updated files back to the server. Any existing page, map, graphic, programming script, or any other portion of the site is thus modifiable. Furthermore, the modular nature of the Atlas and its menu-driven organization allows new parts and options to be added at any time without affecting its current structure.

RICH CONTENT

The rich content of the Atlas is presented here in the form of an outline that exactly reflects the current menu and sub-menu structure of its user interface. It is organized in four logical groups that correspond to the menu bars found on the top, left, right, and bottom sides of the screen.
A) Top Menu Bar offers entry to the Atlas’s main page and contact information:

1) Link to main page
2) “About us” page
3) Contact information

B) Left Menu Bar offers a wealth of textual information about southern Guam natural resources, organized in the following topics:

**Background**
1) Basic concepts
2) Glossary of terms

**Geographic area**
1) Overview
2) Geology
3) Hydrology
4) Climate
5) Soil
6) Vegetation

**Drainage**
1) Overview
2) Stream toponymy
   a) Official U.S. names
   b) Chamorro names
3) Stream profiles
4) Stream flow

**Watersheds**
1) Overview
2) Individual watersheds
   a) Agat
   b) Apra
   c) Cetti
   d) Geus
   e) Inarajan
   f) Malojoj
   g) Manell
   h) Pago
   i) Taelayag
   j) Talofofo
   k) Toguan
   l) Ugum
   m) Umatac
   n) Ylig
Environment
1) Overview
2) Forests
3) Scrub
4) Grasslands
5) Badlands
6) Wetlands
   a) Marshes
   b) Swamps
   c) Estuaries
   d) Mangroves
7) Reefs

Population
1) Overview
2) Municipalities
3) Military lands
4) Protected areas
5) Infrastructure

C) Right Menu Bar offers a wealth of graphical and geospatial information and data about southern Guam natural resources, organized as follows:

Image maps (Pre-formatted maps)
1) Topography
   a) Topographic map
   b) Contour lines, 6 m
   c) Contour lines, 30 m
   d) Elevation
   e) Shaded relief
   f) Digital Elevation Model
   g) Elevation and relief
   h) Slope
   i) Slope aspect
   j) Physiographic divisions
2) Geology
   a) Detailed geology
   b) Simplified geology
   c) Volcanic terrane
   d) Limestone terrane
   e) Faults
3) Climate
   a) Rainfall distribution
4) Soil
   a) Detailed soils
   b) Simplified soils
   c) Volcanic soils
   d) Limestone soils
   e) Bottomland soils

5) Drainage
   a) Drainage network
   b) Main streams
   c) All streams
   d) Theoretical drainage
   e) Low gradient flow
   f) High gradient flow
   g) Major waterfalls
   h) Ponds and reservoirs
   i) Coastal discharge
   j) Stream names
   k) Stream lengths

6) Watersheds
   a) Watersheds
   b) Watershed divides
   c) Watershed coastlines
   d) Subwatersheds

7) Groundwater
   a) Groundwater
   b) Sinkholes
   c) Caves
   d) Springs

8) Environment
   a) Detailed vegetation
   b) Simplified vegetation
   c) Forests
   d) Scrub
   e) Grasslands
   f) Badlands
   g) Marshes and swamps
   h) Estuaries and mangroves
   i) Reefs

9) Population
   a) Urban buildup
   b) Agricultural lands
   c) Village locations
   d) Municipal boundaries
   e) Military areas
   f) Protected areas
10) Infrastructure
   a) Routes
   b) Main roads
   c) All roads and streets
11) Imagery
   a) Image 1

Geospatial data
1) GIS
   a) On-line viewer
   b) Data download
2) Google Earth
   a) Examples
   b) Data download
3) Download software

Photo gallery
1) Rivers
2) Landscapes
3) Aerials

Publications
1) Project documentation
2) Publications

Media and events
1) News
2) Current issues
3) Events

Links
1) WERI
2) IREI
3) GovGuam
4) Guam BSP
5) NOAA
6) USGS

D) Bottom Menu Bar includes disclaimer and legal notices:
   1) Copyright notice
   2) Disclaimer notice
   3) Privacy notice
DOWNLOAD OPTIONS

One of the primary goals of the digital Atlas is to provide access to up-to-date information and data to users who need it for their own purposes and other applications. For that reason the Atlas offers a wide range of download options, through which the users can save textual, graphical, and most importantly, geospatial information on their own computers. A range of text documents, spreadsheet files, and high quality color photographs are all available. An extended series of pre-formatted and nicely designed JPG maps in high resolution covering the wide range of natural resources outlined above are all available for download and use. Each of the 58 image maps (e.g., detailed geology, or scrub vegetation, or drainage network, etc.) is available in 15 versions: full southern Guam overview and closeups for each watershed; making a total of 870 distinct maps that can be downloaded from the website. Importantly, every GIS file that was used in the creation of the Atlas and all maps included within is also available for direct download in its original form, as explained below.

GIS AND GOOGLE EARTH INTEGRATION

One of the primary purposes of the digital Atlas is to act as a distribution center of GIS data. Therefore, a significant portion of it is focused on GIS information and applications. Every map presented in the atlas is accompanied by download links where users can obtain original GIS data used to created the map in question. This includes all types of GIS data (as relevant to a particular map), such as point, polyline and polygon shapefiles, grid coverages, georeferenced images, etc. Each and every data set is available in two versions: NAD83, which was specified as preferred by the Atlas planning committee, and WGS84, which is emerging as a preferred standard by the wider audience. In addition, most GIS data can be browsed and pre-viewed on-line without actually downloading it, using a java-script based mini-GIS application. Finally, in order to make a greater range of geospatial capabilities accessible to users with no GIS experience or software, most GIS data is also downloadable in KML versions for use with the increasingly popular Google Earth software. For added convenience, links where users can download free geospatial software are also provided.

SCREENSHOTS

The following pages include a couple of screenshots of select pages of the digital Atlas.
Select introductory pages (general introduction to Guam, basic concepts, glossary, river toponymy).
Fig. 3

Select textual information pages (geology, hydrology, freshwater marshes, reefs).
Select image map pages (shaded relief topography, detailed geology, simplified vegetation, groundwater, sub watersheds, protected areas).
Fig. 5

Select geospatial information pages (on-line GIS data viewer, GIS data download page, Google Earth application page).
**Fig. 6**

<table>
<thead>
<tr>
<th>Southern Guam landscapes and natural features:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Image of landscapes and natural features" /></td>
</tr>
</tbody>
</table>

Select photo gallery page (landscapes and natural features of southern Guam).