

Mapping Sciences: The Pandora's Box of GIS?



Michael Barnes

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Geomatics Experts Group

Jack Verouden, Chair of OGP Surveying & Positioning Committee
Michael Barnes, Chair of Americas Petroleum Survey Group

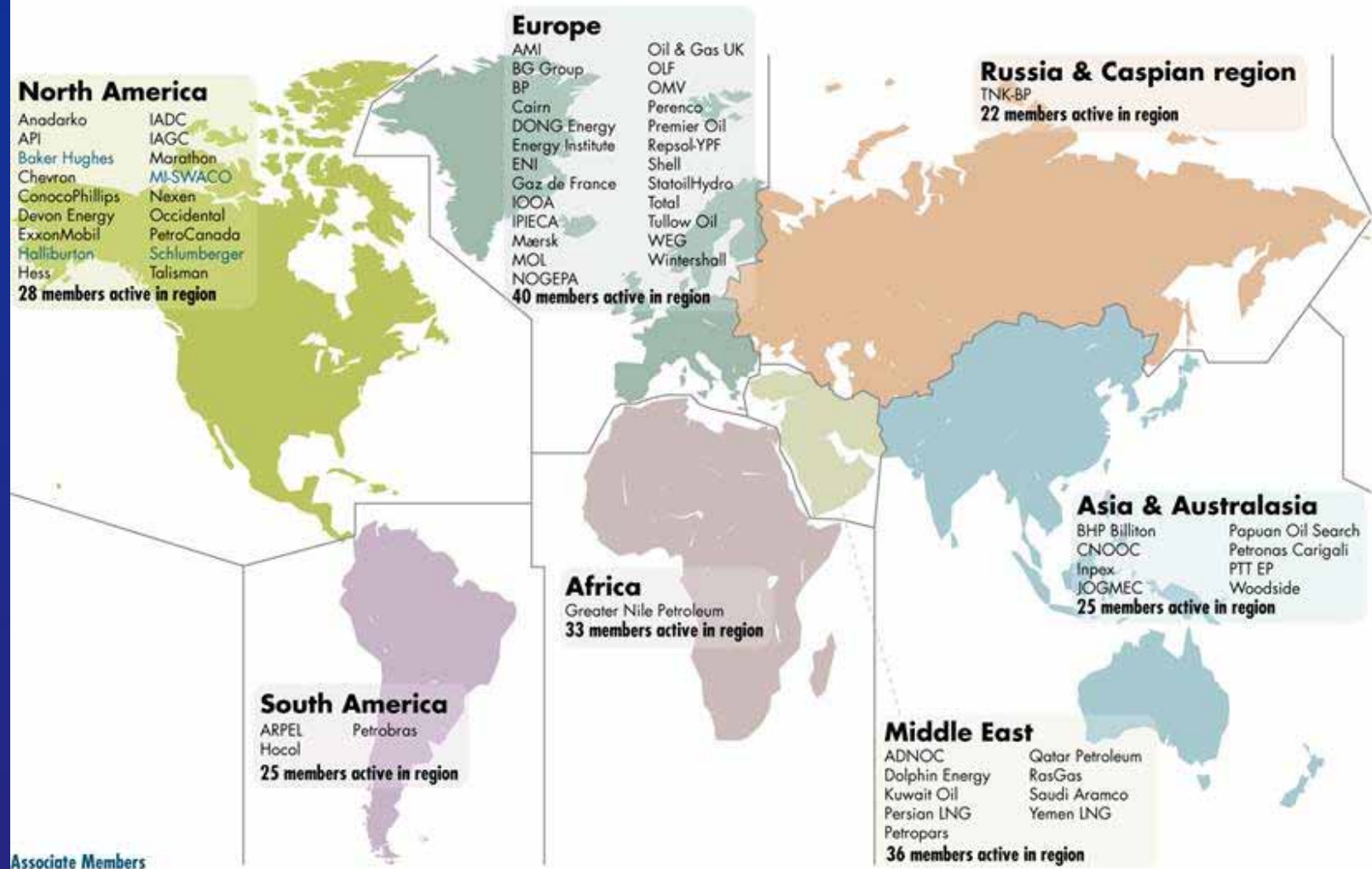


Content

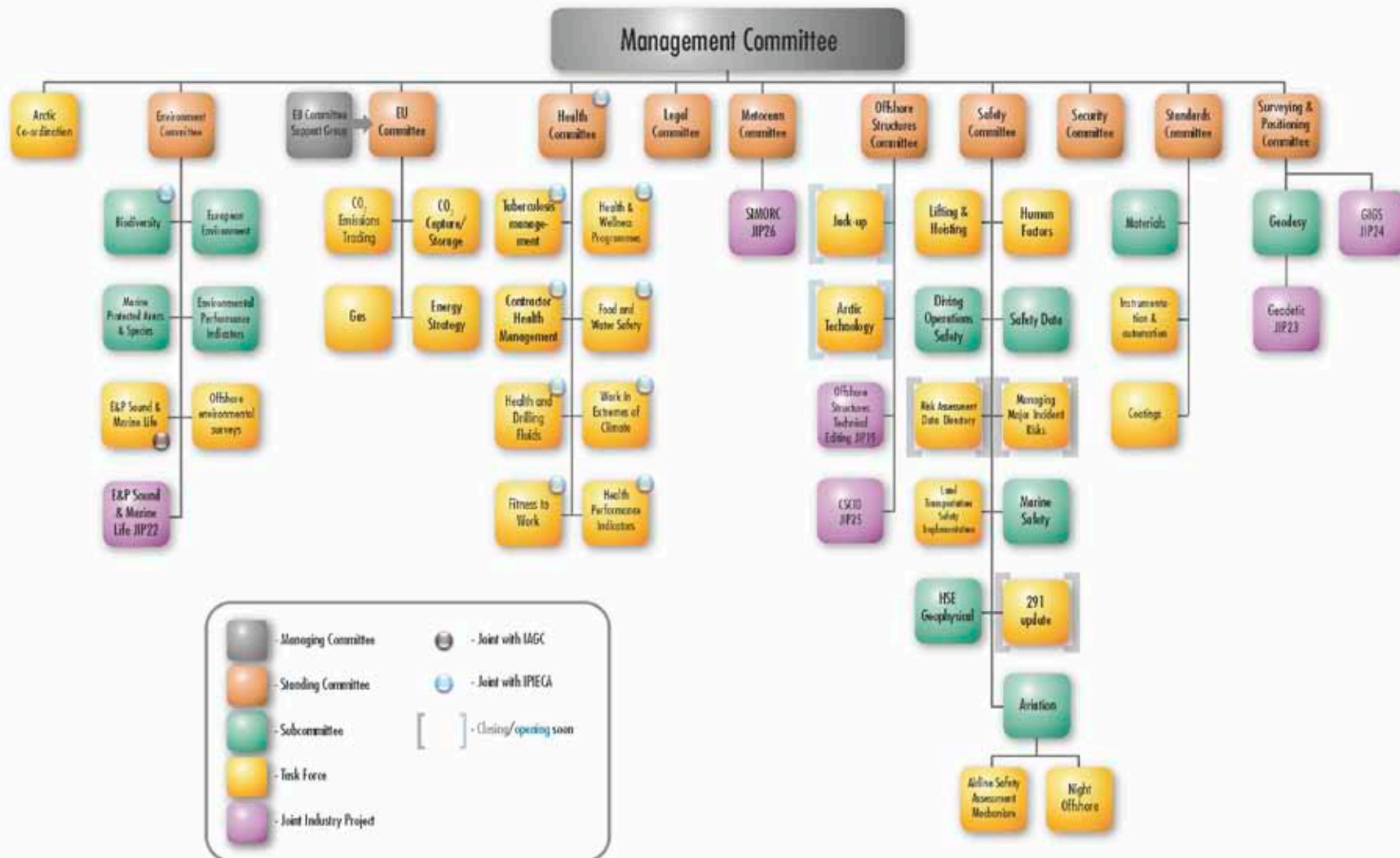
- Who are OGP S&P and APSG
- Definitions in Mapping Sciences
- Our dependence on maps
- Fundamentals of Map Making
- Examples

OGP Membership

Base region of Members



OGP Structure





OGP S&P “Silverware”

- EPSG Geodetic Parameter Dataset
the de-facto standard in the Oil and Gas industry and beyond for geodetic parameters worldwide
- Guidance Notes (10) published on OGP website
- Owner of UKOOA Positioning Standards (5). Published on OGP website
- Active Survey and Positioning Committee
- Active Geodetic Working Group



APSG Organization

- Americas Petroleum Survey Group
- **Formed 10 November 1998**
- Unincorporated association of individuals, 60+ members

The purposes of the APSG are to advance survey technology relative to the worldwide petroleum industry and to disseminate information to APSG members in respect of worldwide petroleum geodesy, surveying, cartography, and spatial data management.



Petroleum Industry Education Activities

- Oceanology International, Oct 2002 (50 audience)
- ESRI PUG, Feb 2004 (115 audience)
- Oklahoma University Colloquium, November 2004 (100 audience)
- ION, Jan 2005 (40 audience)
- IHS Users Group and Symposium, Jan 2005 (85 audience)
- ESRI PUG, Mar 2005 (100 audience)
- GIS in the Rockies, Sep 2005 (45 audience)
- SPE Wellbore Positioning Technical Section, Nov 2005 (100 audience)
- SEG Special Technical Session, Nov 2005 (125 audience)
- ESRI PUG, Mar 2006 (110 audience)
- ESRI PUG, Feb 2007 (120 audience)
- SPE ATW on Well Positioning, Oct 2006 (100 audience)
- HGS and GSH Geosciences Education Day, Sep 2007 (108 audience)
- ESRI PUG, Feb 2008 (140 audience)
- EAGE Rome, Jun 2008 (100 audience)



Our Joint Geospatial Papers at EAGE 2008

540 years of experience from 11 companies

Introduction of OGP S&P and the APSG: Objectives and Resources

J. Verouden (Shell) & B. Carter (BP)*

Geodesy and Cartography in E&P: A Caution to Skilled Professionals

J. Cain (Cain and Barnes) & M. Barnes (Cain and Barnes)*

Concession and Lease Boundary Delineation

R. Lott (Geodetic Working Group Chair) & L. Romeijn jr. (Zeus Imaging)*

Geodetic Integrity in Seismic Acquisition and Processing

M. Redford (Petro-Canada), J. Conner (EnSoCo) & D. Salvage (ExxonMobil)*

Understanding Borehole Surveying: Directional Drilling Survey Accuracies

A. Jamieson (Tech21) & M. Michell (Devon Energy)*

The new EPSG Geodetic Parameter Registry

R. Nicolai (Shell) & G. Simensen (StatoilHydro)*

Data Quality Monitoring: Improving Geodetic Integrity of E&P Data

R.J. Wylde (ExxonMobil) & P. Lesslar (Shell)

Truth or Consequences: Commercial Impact of Geospatial Data Management

J.P. Stigant (Devon Energy), M. Jensen (retired Shell) & R. bin Ahmad (Petronas)*

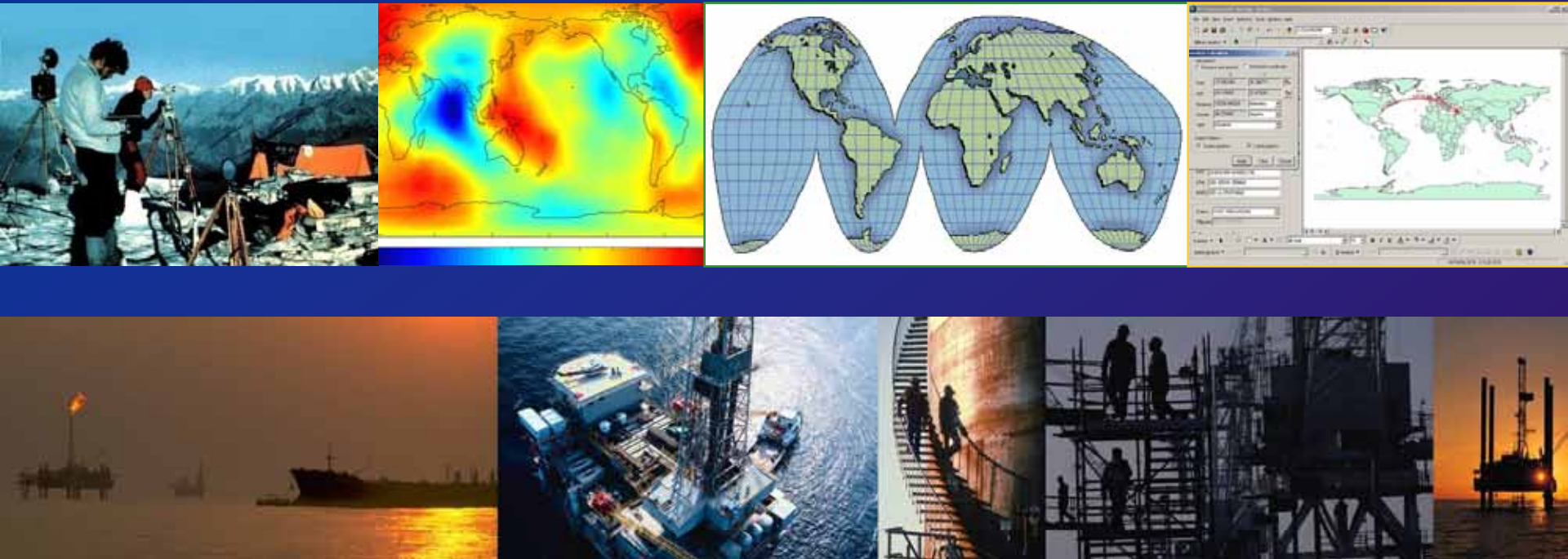


APSG participation in ESRI PUG 2009

5 years of volunteering for PUG

Check out the program ..

- Geospatial Assurance by Devon team
- **Geodesy Considerations Session**
- APSG Session in Richmond Room tomorrow from 0830 hours for ...
 - Co-ordinate Reference Systems 101 ... demystify GeogCRS, ProjCRS *et al*
 - The New Web based Geodetics Registry
 - **ArcGIS 9.3 Geodetics Update and The LIST**
 - Applied Geodetics for ArcGIS
 - Truth of Consequences: The Cost of Poor Mapping ...



Back to Pandora's Box

In Greek mythology, Pandora opened the box out of curiosity then all of the evils, ills, diseases, and burdensome labour that mankind had not known previously, escaped from the box. However, Pandora was quick enough to close it again and keep one value inside: hope. We are not told why hope alone remained in the box.

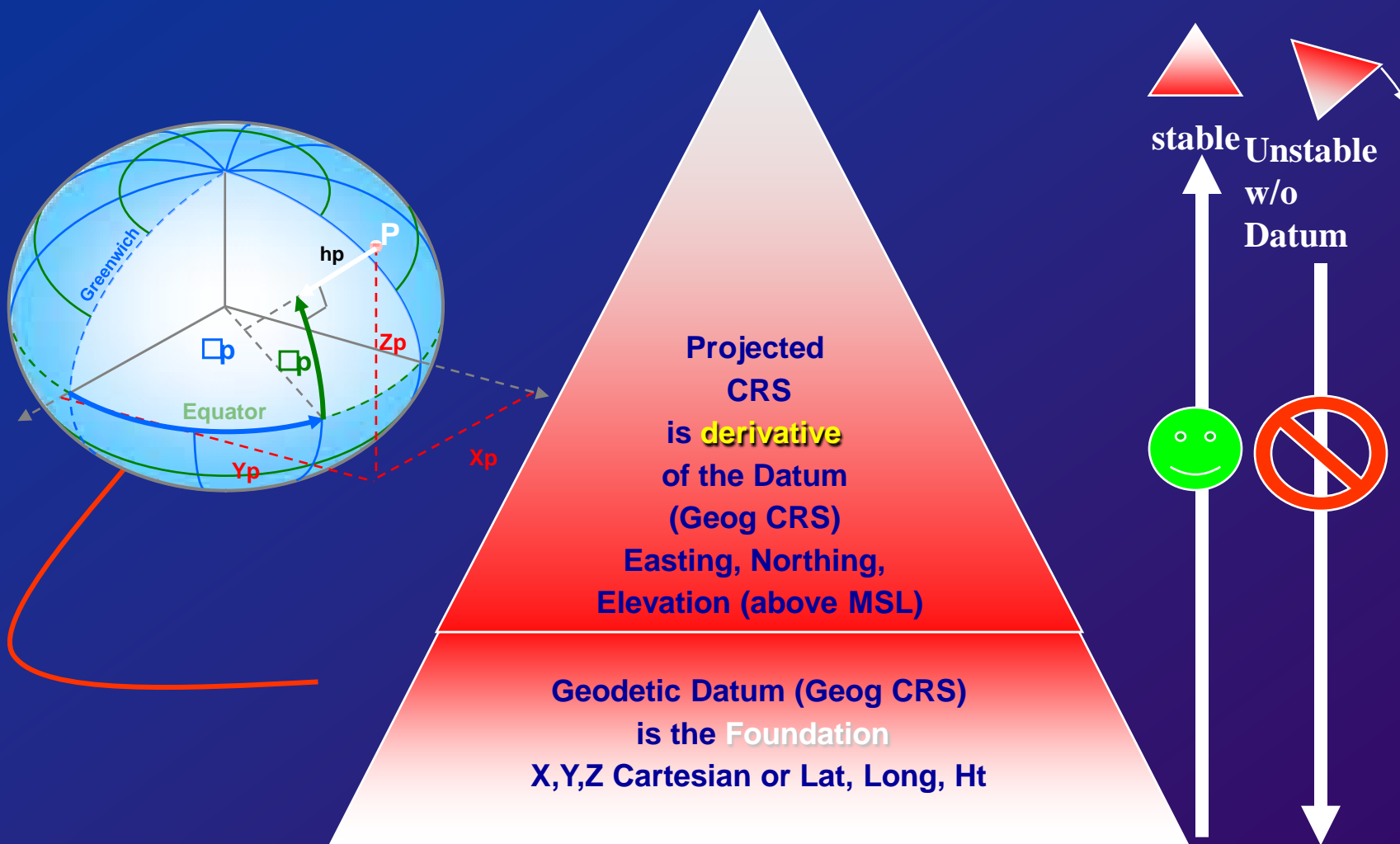


Definitions

- **Geodesy**: Mathematics of size and shape of earth
- **Cartography**: Science and art of representing natural and fabricated features
- **Map**: Two dimensional representation of three dimensional features

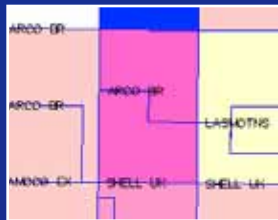
Hierarchy of Mapping

12

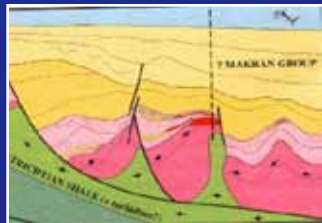


E&P Dependence on Map Products

80% of all E&P data has a spatial component



Explore



Appraise



Develop



Produce



Decommission



Each has multiple mapping activities

Exploration

- Boundaries
- Seismic
- Wells

Development

- FEED
- Pipelines
- Facilities
- Operations and Maintenance



Fundamentals of Map Making

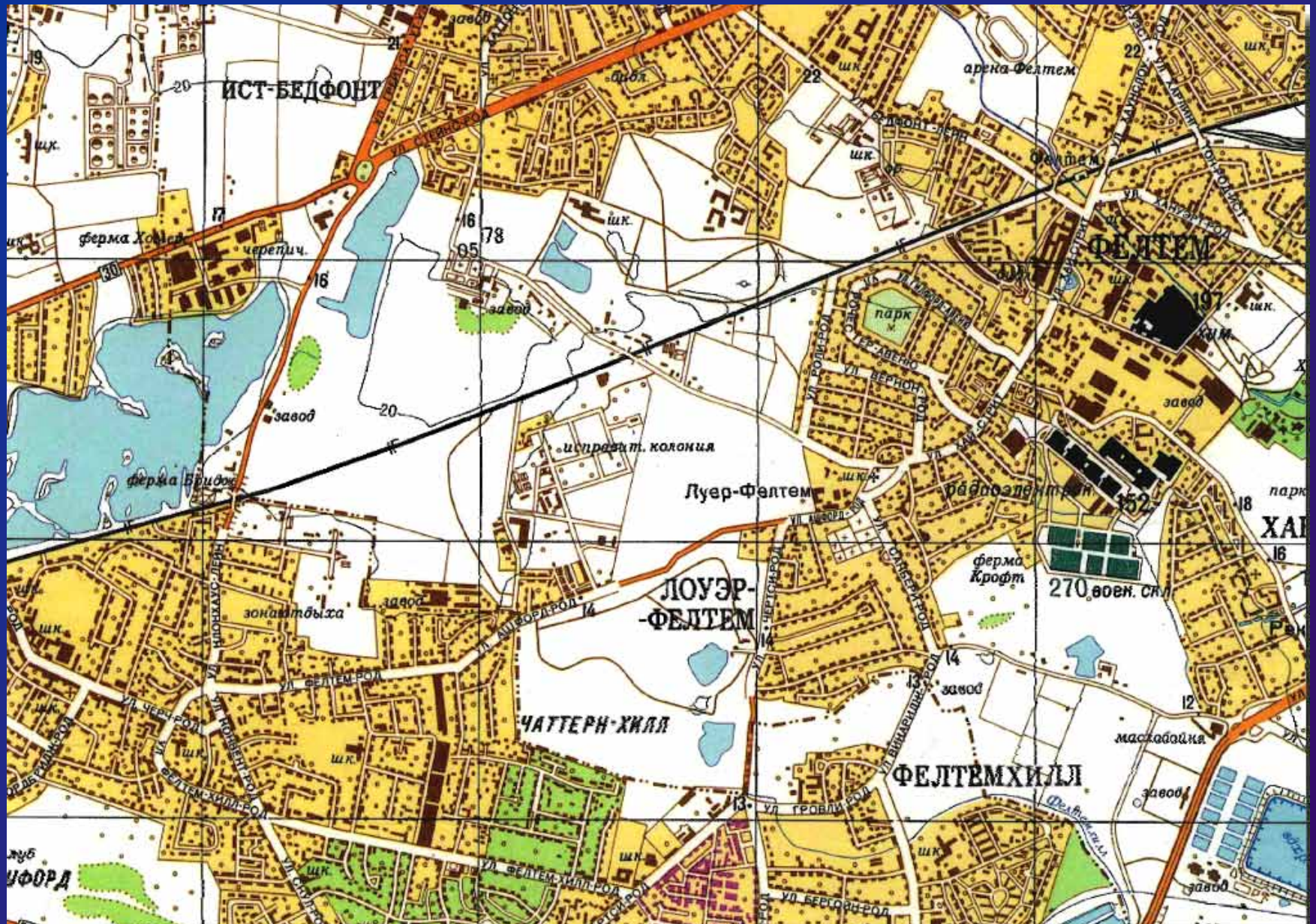
- Design Principles
- Design Factors
- Map Specifications
- Map Compilation
- Map Sheet Basics
- Production, Control, and Documentation



Design Principles

Who, What, When, Where, Why and How?

- Purpose
- Target Audience
- Economy of Effort
- Simplicity





Design Factors

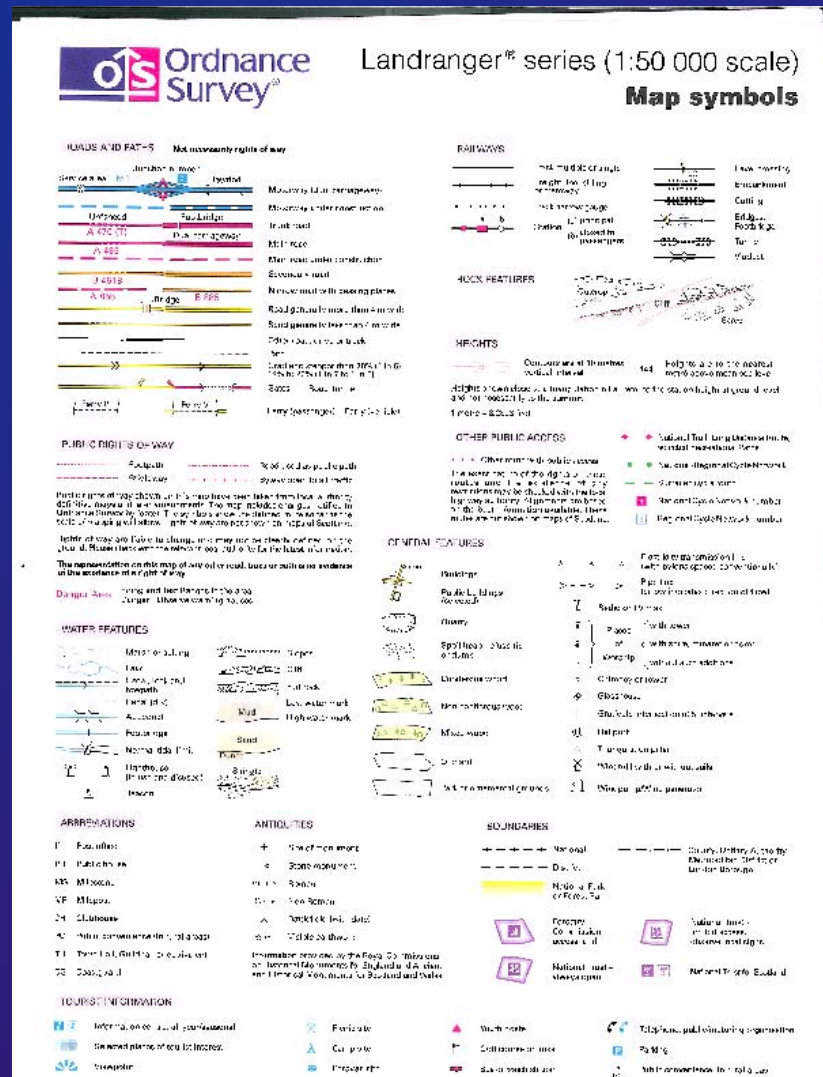
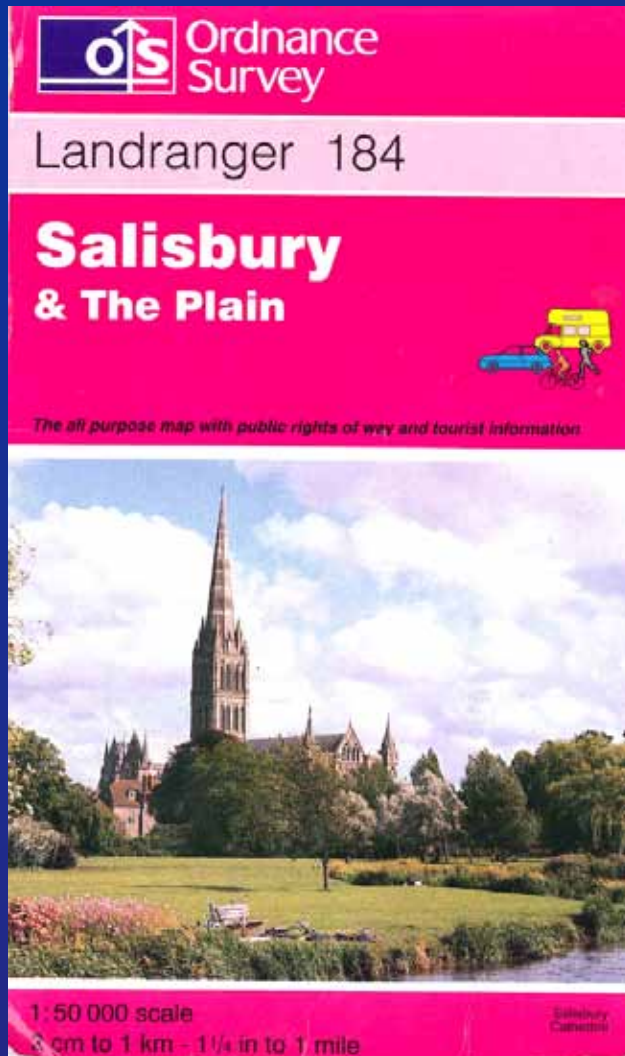
- Scale and Content
- Legibility
- Clarity
- Geographic Area
- Source Material
- Updating
- Emphasis
- Relief Depiction
- Accuracy
- Time and Resources
- Sheet Size



Map Specifications

- Did Pandora leave this one in the box?

National Mapping is a wealth of useful information





Map Sheet Basics

- Map Scales
- Map Orientation
- Units of Measurement
- Marginal Information
- Information Shown in The Border

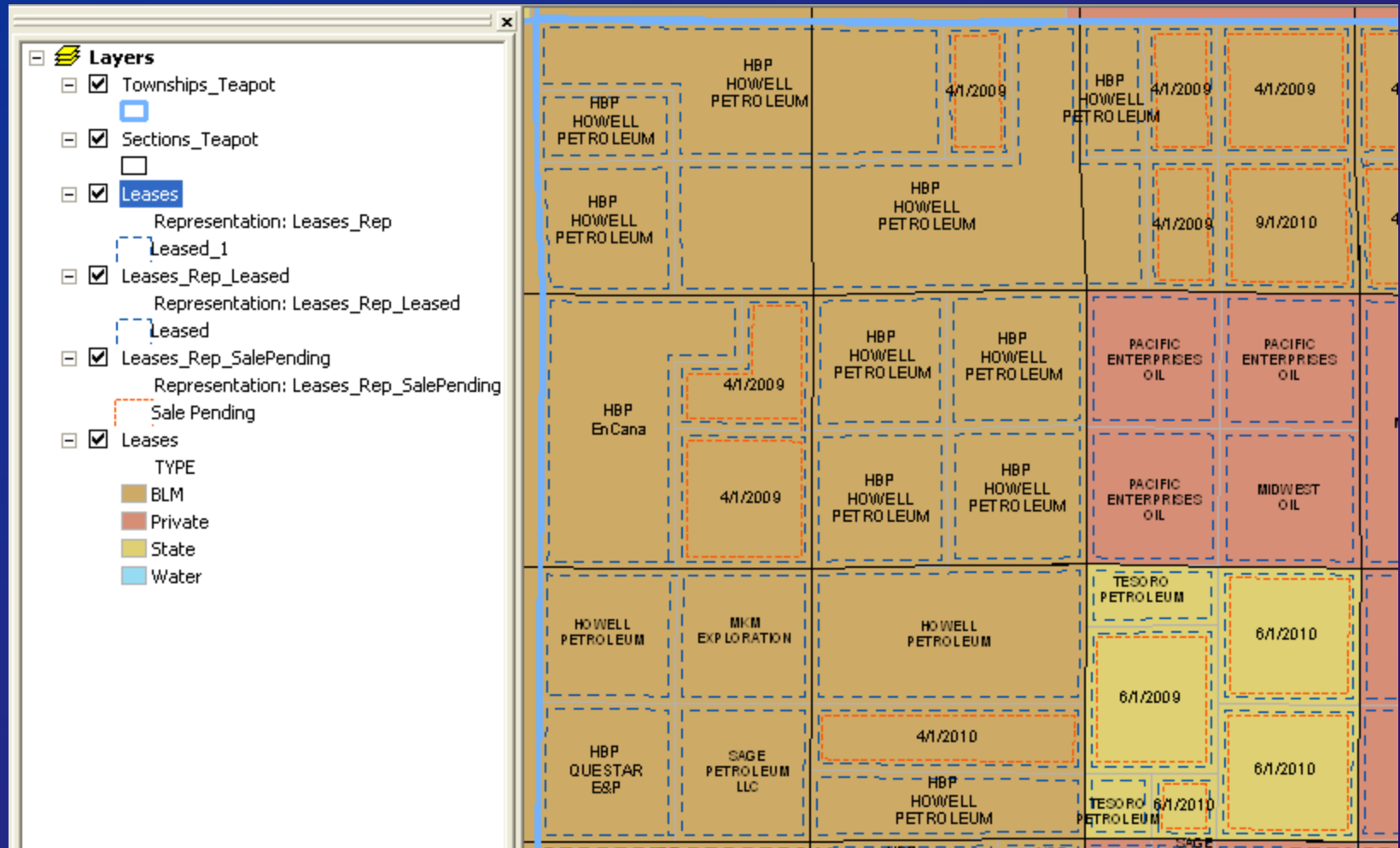
- GEODETIC INFORMATION !
 - e.g. NAD27 UTM Zone 15 N



Map Evaluation and Compilation

- Collection of Source Material
- Evaluation of Source Material
- Selection of Map Material
- Cartometric Testing

Cartographic Representations





Production, Control, and Documentation

- Screen, presentation, web, paper, or combinations
- Sheet numbering convention, date
- METADATA

Maplex





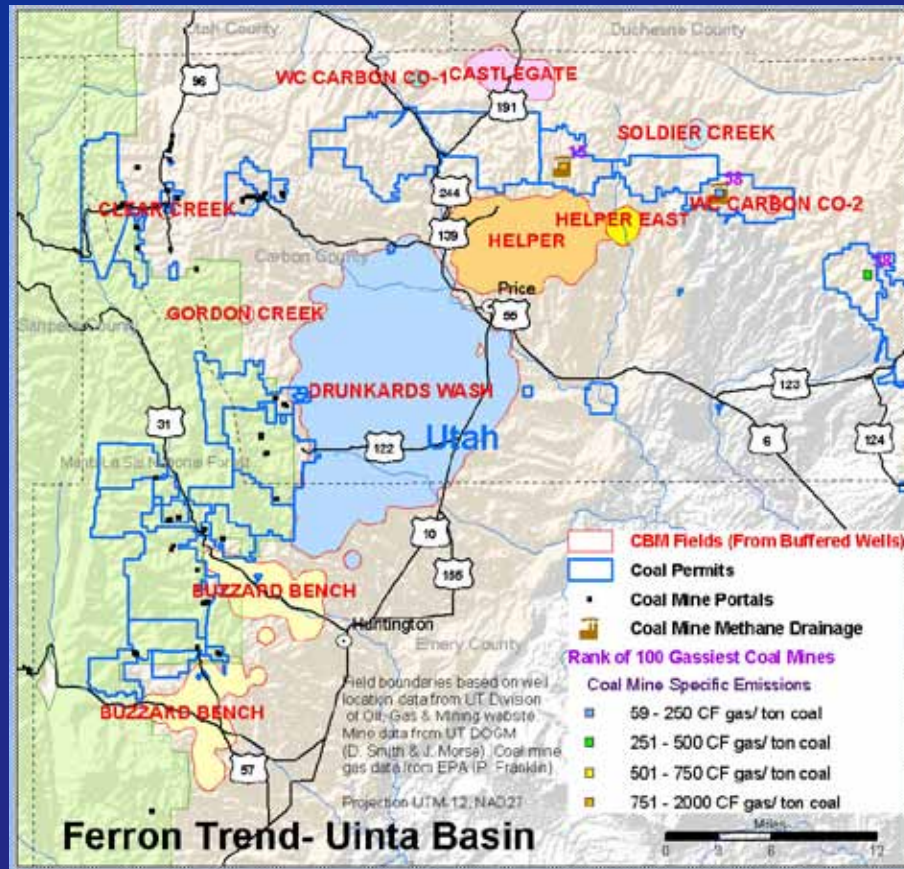
Maplex Advantages

Maplex provides:

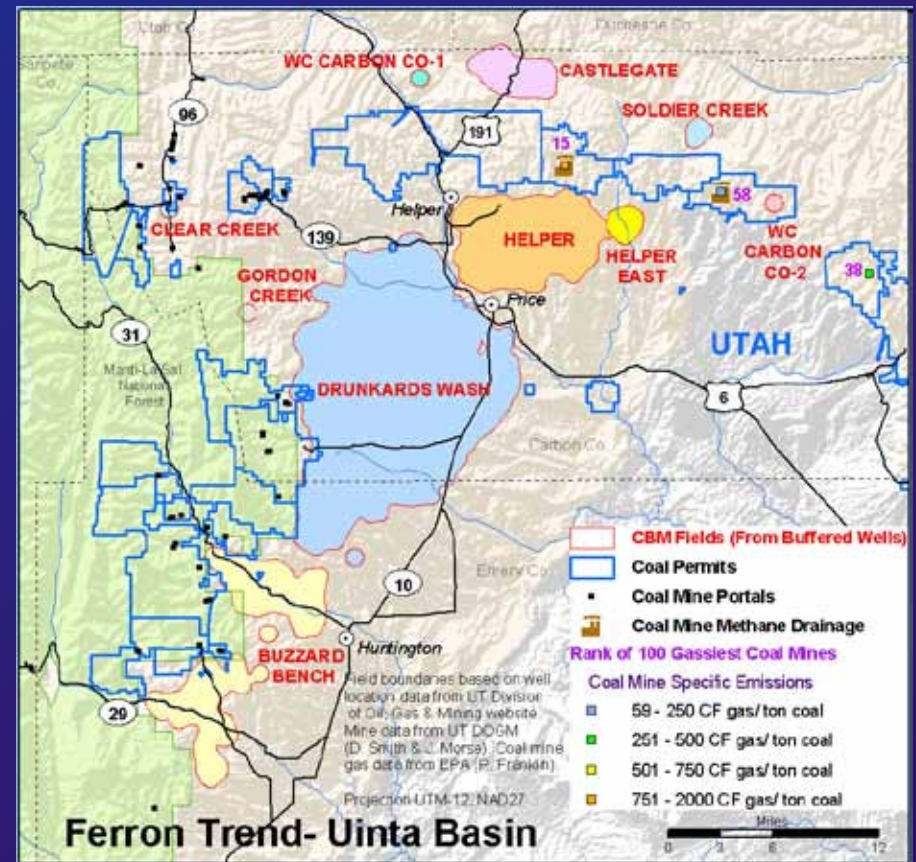
- Placement, alignment, and spacing of labels
- Character spacing within labels
- Label stacking and abbreviation
- Feature levels of importance
- Conflict resolution

Auto-Labeling vs. Annotation

Auto-Labeled



Labels converted to Annotation & Manually Placed

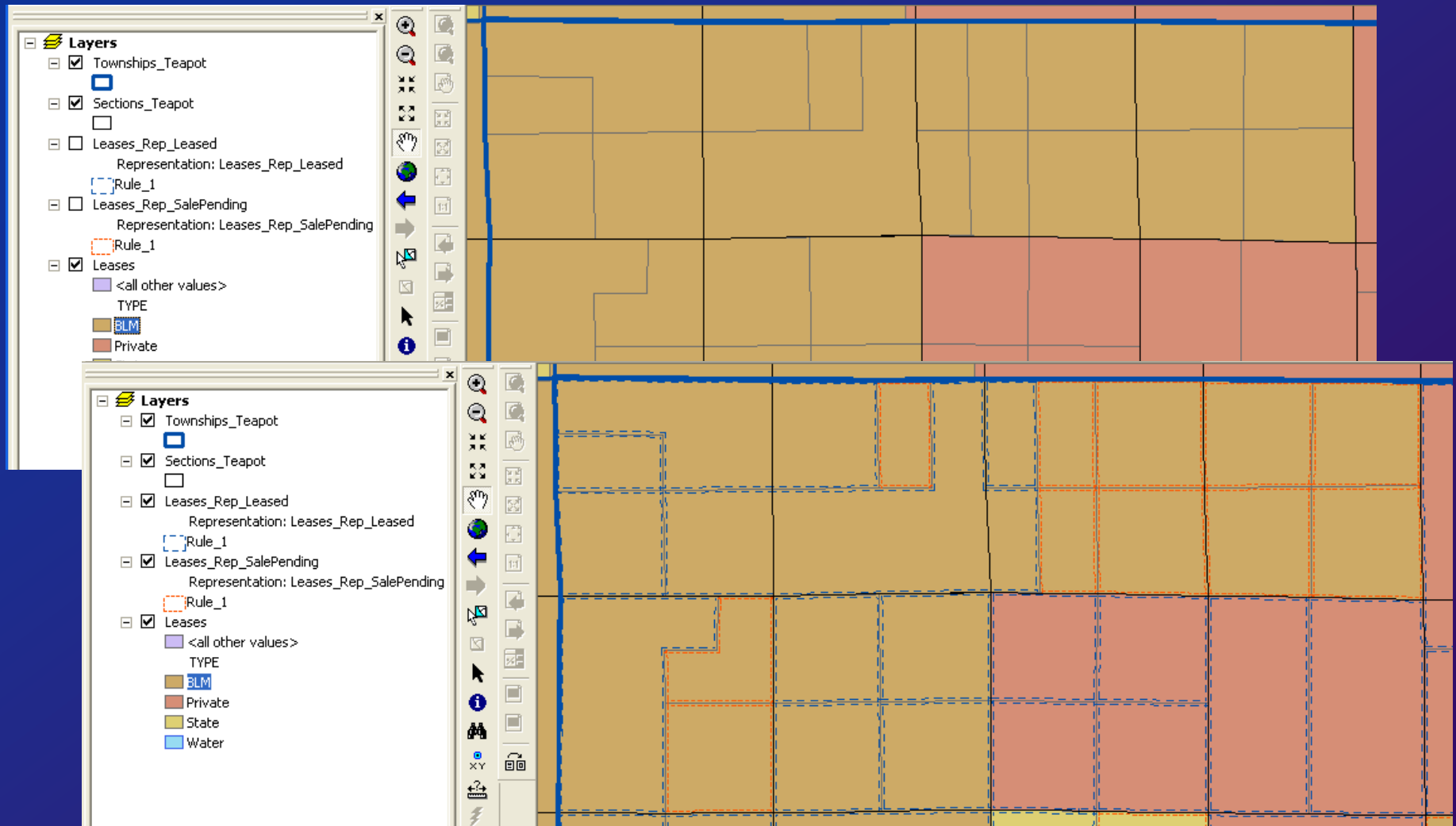




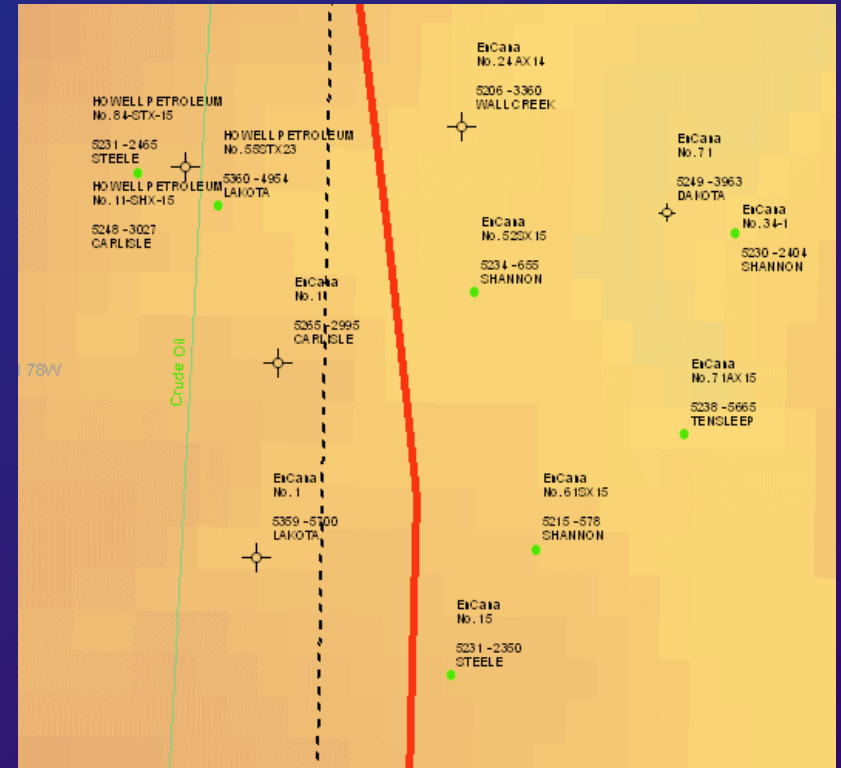
Annotation means

- Map Document Annotation
- Annotation Groups
- Adding Annotation with the Draw Toolbar
- Setting your Active Annotation Target
- Adding with the Label Features Tool
- Converting Label to Annotation
- Overflow Window
- Geodatabase Annotation
- Reference Scale
- Standard vs. Feature Linked Annotation
- Workflow for Creating Geodatabase Annotation
- Editing Geodatabase Annotation
- Edit Annotation Tool

Cartographic Representations



Maplex on



Point: placement & conflict resolution

Placement Properties [?] [X]

Placement | Conflict Detection

Point Settings

☐ Offset label horizontally around the point

2	2	1
3		2
3	3	2

Prefer Top Right, all allowed

Change Location...

Priority: 0 = Blocked, 1 = Highest, 3 = Lowest

☒ Place label on top of the point

☐ Place label at specified angles

Angles...

☐ Place label at an angle specified by a field

Rotation Field...

Duplicate Labels

☒ Remove duplicate labels

☐ Place one label per feature

☐ Place one label per feature part

OK Cancel

Placement Properties [?] [X]

Placement | Conflict Detection

Label Weight

Label weight: High

This determines whether the labels in this layer can be overlapped by labels from other layers. The higher the weight, the less likely the labels are to be overlapped.

Feature Weight

Feature weight: None

This determines whether the features in this layer can be overlapped by labels from this or any other layer. Labels will only be placed over features with a lower weight.

Tip: For fastest drawing speed use feature weight None.

Buffer

Buffer defined as a ratio of the label's height: 0

This prevents adjacent labels from being placed too close together by defining a buffer around each label within which no other labels will be placed.

Tip: 0 = no label buffer, 1 = label buffer same height as label.

☐ Place overlapping labels

OK Cancel

Maplex off

Point: placement & conflict resolution

The image displays three instances of the **Placement Properties** dialog box, each showing a different tab:

- General Tab:** Shows options for label placement. The **Center** button is selected, indicating the label is centered on the point. Other options include **Position...** (highlighted with a red arrow), **Label Offset...**, **Orientation...**, **User-defined zones**, and **May shift label upon fixed position**.
- Label Fitting Strategy Tab:** Shows options for fitting labels. The **Stacked Label** button is selected, and the **Stack label** checkbox is checked. Other options include **Reduction** (with **Reduce font size** checkbox) and **Abbreviation** (with **Abbreviate label** checkbox).
- Conflict Resolution Tab:** Shows options for resolving conflicts. The **Weight** button is selected, and the **Feature weight** is set to 1. Other options include **Background label**, **Remove duplicate labels**, **Never remove label**, and **Label Buffer** (set to 15 % font height).

The **Position Options** sub-dialog box is also shown, displaying a grid of placement options:

- Northwest, North, Northeast
- West, Centered, East
- Southwest, South, Southeast
- Offset, Best Position

Maplex on




<p>No. 8-WC2 HOWELL PETROLEUM</p> <p>No. 20 HOWELL PETROLEUM</p> <p>No. 32WC2NW06 No. 34</p>	<p>No. 6-1 No. 6-2 No. 6-3 No. 14 22WC2NE06 No. 38 No. 17 No. 10 11-MX-10 No. 27 No. 53-SX-10</p>	<p>No. 4 No. 10 No. 17 No. 10 No. 27 No. 53-SX-10</p>	<p>HOWELL PETROLEUM</p> <p>No. 38 Lease Sale Pending</p>	<p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>
<p>HOWELL PETROLEUM</p> <p>No. 30 No. 6-1</p>	<p>HOWELL PETROLEUM</p> <p>No. 11 No. 8 No. 21 No. 29 No. 26 No. 40WC2NW05</p>	<p>No. 38 No. 21 No. 29 No. 26 No. 40WC2NW05</p>	<p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>
<p>No. 03WCXNW07S VCXNW07S No. 11VCXNW07S No. 16A7 21WCXNW07S No. 32WCXNW07S</p>	<p>No. 06WC2NE07S 06WC1NE07S No. 19WCXNE07S No. 26WCXNW07S No. 7-68 No. 11WC1SW07S No. 26WC1SW07S</p>	<p>No. 08WCXNW08S No. 8-42 No. 28WC1NW08S</p>	<p>No. 4AX No. 8-41 No. 23WC2NE08S</p>	<p>PACIFIC ENTERPRISES OIL</p>	<p>No. A-</p>
<p>EnCana</p>	<p>HOWELL PETROLEUM</p> <p>No. 16WC2SW08S</p>	<p>HOWELL PETROLEUM</p> <p>No. 09WC2SE08S No. 16WC2SW08S</p>	<p>HOWELL PETROLEUM</p>	<p>PACIFIC ENTERPRISES OIL</p> <p>No. 1</p>	<p>MIDWEST OIL</p>
<p>HOWELL PETROLEUM</p> <p>No. 6AX No. 7AX No. 9AX</p>	<p>MKM EXPLORATION</p> <p>No. 1 No. 5A7 No. 18-320</p>	<p>No. 17-42 No. 17-41 No. 17-45 No. 17-46 No. 17-47</p>	<p>TESORO PETROLEUM</p> <p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>
<p>No. 17WC2SW18S</p>	<p>SAGE PETROLEUM LLC</p>	<p>Lease Sale Pending</p>	<p>HOWELL PETROLEUM</p>	<p>Lease Sale Pending</p>	<p>Lease Sale Pending</p>



WE
FIX
EVERYTHING
FROM DAYBREAK TO HEARTBREAK


BARACE


ESRI Resources





ArcGIS 9.2 Desktop Help


[search options](#)


 Welcome to ArcGIS Desktop Help


 Copyright information


 GIS Dictionary


 What's new in ArcGIS


 Getting started


 Map projections and coordinate systems


 Mapping and visualization


 Editing and data compilation


 Geoprocessing


 Geoprocessing tool reference


 Geodatabases and ArcSDE


 Data management with ArcCatalog


 Data support in ArcGIS


 Extensions


 Geocoding and address management


 Linear referencing


 Network analysis


 Mobile GIS


 Interoperability and standards support

 Customizing and developing with ArcGIS

 Guide to data that comes with ArcGIS

 Licensing and desktop administration

 ArcGIS Image Server

 GIS Servers and services

Release 9.2 Last Modified March 15, 2007

Welcome to ArcGIS Desktop Help 9.2

Please use the links in the table of contents on the left to navigate the topics in ArcGIS 9.2 Desktop help. Also browse the links below to find information about common tasks or extensions.

Getting Started

- [What's new in 9.2](#)
- [Tutorials and video](#)
- [Working with geographic information](#)
- [Projection basics](#)

Mapping and Visualization

- [Exploring layers](#)
- [Layouts and printing](#)
- [Common tasks within ArcMap](#)
- [Cartographic representations](#)
- [Animating data](#)

Geodatabase and ArcSDE

- [Common Geodatabase tasks](#)
- [File geodatabase](#)
- [ArcSDE Administration](#)
- [ArcSDE connections](#)

ArcGIS Extensions

- [3D Analyst](#)
- [ArcScan](#)
- [Data Interoperability](#)
- [Geostatistical Analyst](#)

Editing data

- [Creating features](#)
- [Moving features](#)
- [Editing attributes](#)

ESRI Resources

 **ESRI Mapping Center**

ESRI.com | Support | EDN | Training | More ESRI

Welcome!
[Login](#)

Home | Blog | Ask A Cartographer | Maps | ArcGIS Resources | Other Resources

Welcome to Mapping Center

Mapping Center is about ***the use of ArcGIS in the graphic delivery of geographic information***. Its goal is to help you make great looking maps by using the same cartographic concepts and techniques that professional cartographers use.

Current News Feeds

Symbolizing trees

We recently got this in an email from an ESRI colleague:

"I went to TOSCA's (The Oxford Seminars in Cartography) Field Trip last night in the Christ Church Library. There were lots of 16th and 17th century maps to be seen. One of the most striking was Frederick Young's Plan of the Parish of Hawkhurst (1818). The way the small woods are depicted and symbolised is fantastic. The symbology of the bushy tree is graded from yellow/brown to green. Can we do this in ArcGIS?"

...(read more)



Mapping Center Web Site

- [About Mapping Center](#)
- [About the Mapping Center Team](#)
- [Getting Started](#)
- [Site Map](#)

Mapping Center Blog

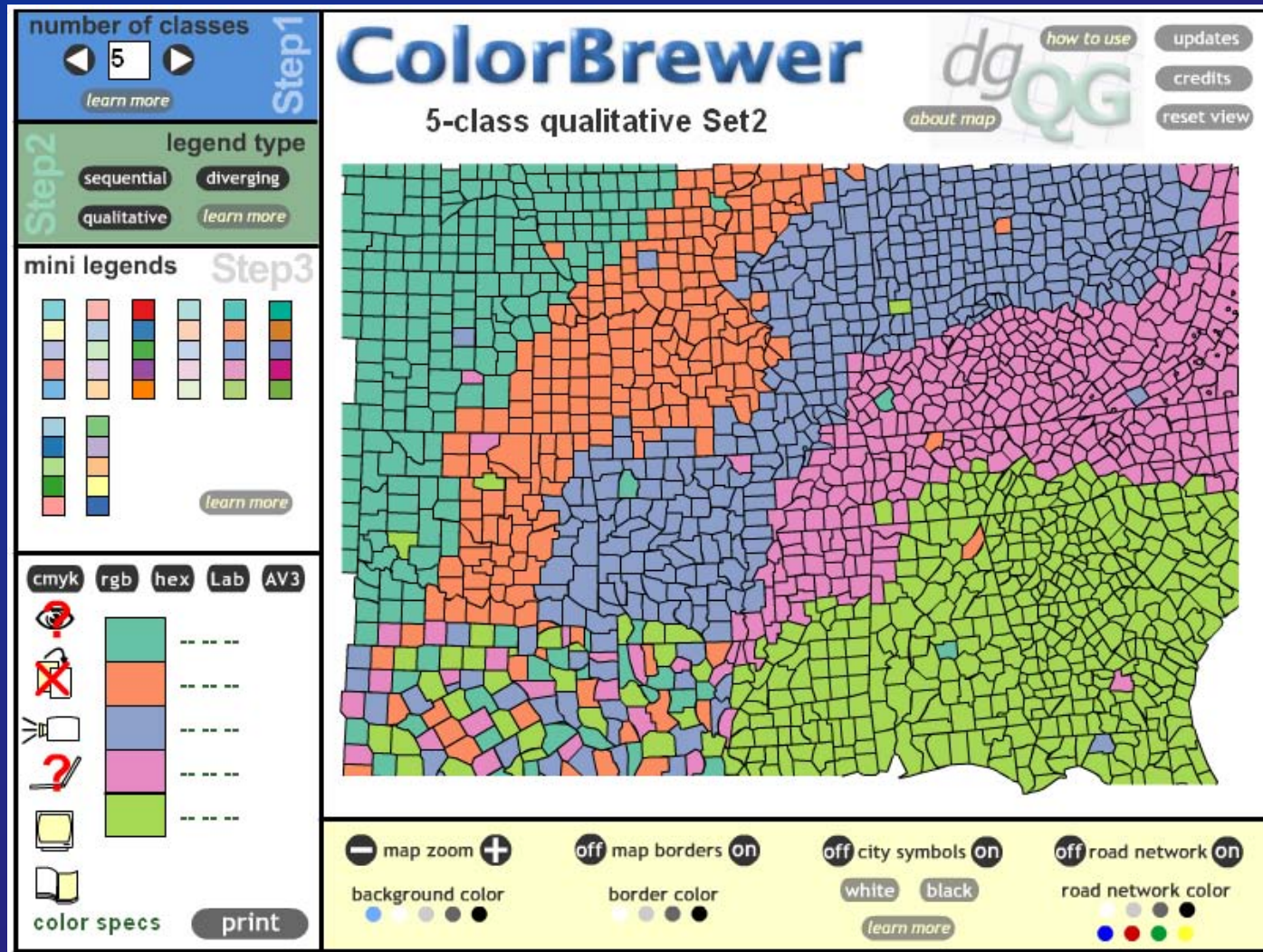
- [About the Blog](#)
- [Terms of Use](#)
- [Submit an Entry](#)

RSS

Announcements

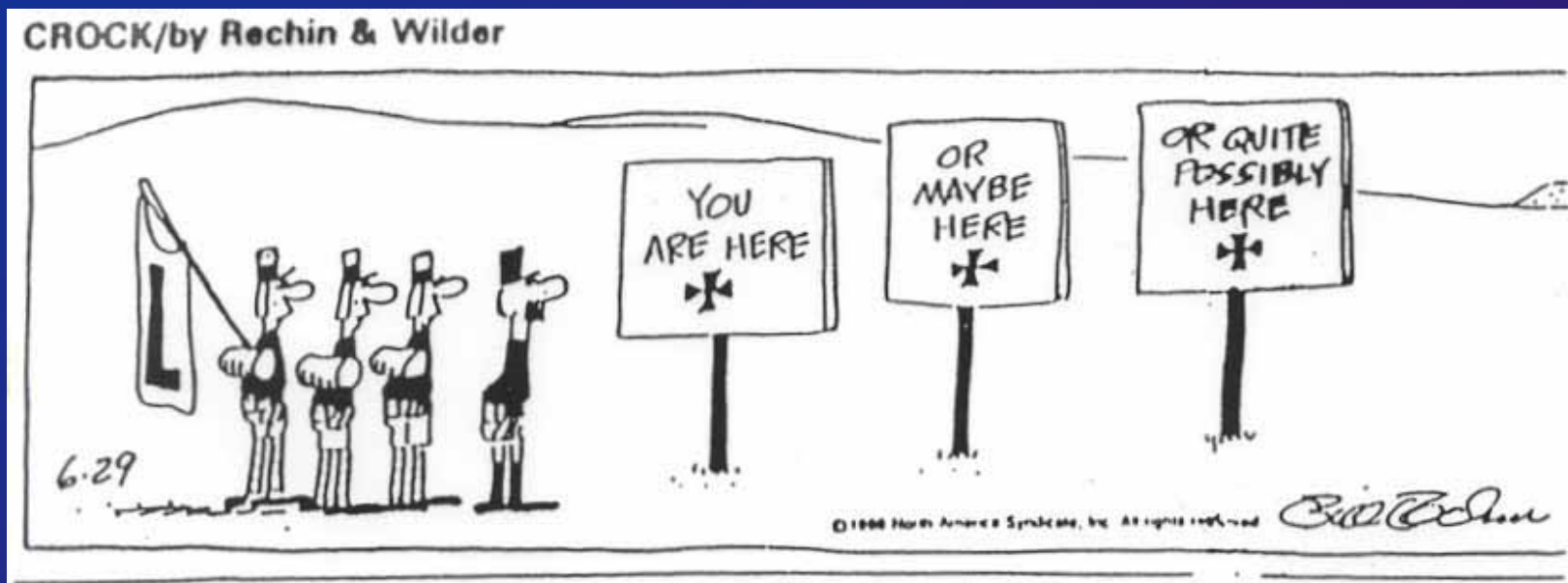
We are in the process of reviewing this web site to improve your user experience. If you have any suggestions, please feel free to [send them to us](#)! We appreciate your input!

Other Resources



ColorBrewer.org

Mapping Examples for Consideration



High Water Worries

[THE CONSEQUENCES]

Inundation from the Ice Sheets

If today's ice sheets disappear, the resulting rise in global sea level would transform coastlines around the world; the effects on the Florida coastline are shown below. Actually, if climate change caused one ice sheet to disappear, parts of others would do so as well, and the effects on sea level would be even greater than what is depicted here.



▲ **West Antarctic ice sheet** holds enough ice to raise sea level globally by **19 feet**. Coastal and south Florida would be flooded.

▲ **Greenland ice sheet** is the equivalent of **24 feet** of global sea level. Flooding in Florida would be similar to the West Antarctic case.

▲ **East Antarctic ice sheet** could raise sea level globally by **170 feet**. Virtually the entire state of Florida would be underwater.

The Unquiet Ice by Robin E. Bell

Scientific American, Feb 2008, v298 n2, pp 60-67

[THE THREAT]

World's Greatest Ice Sheets

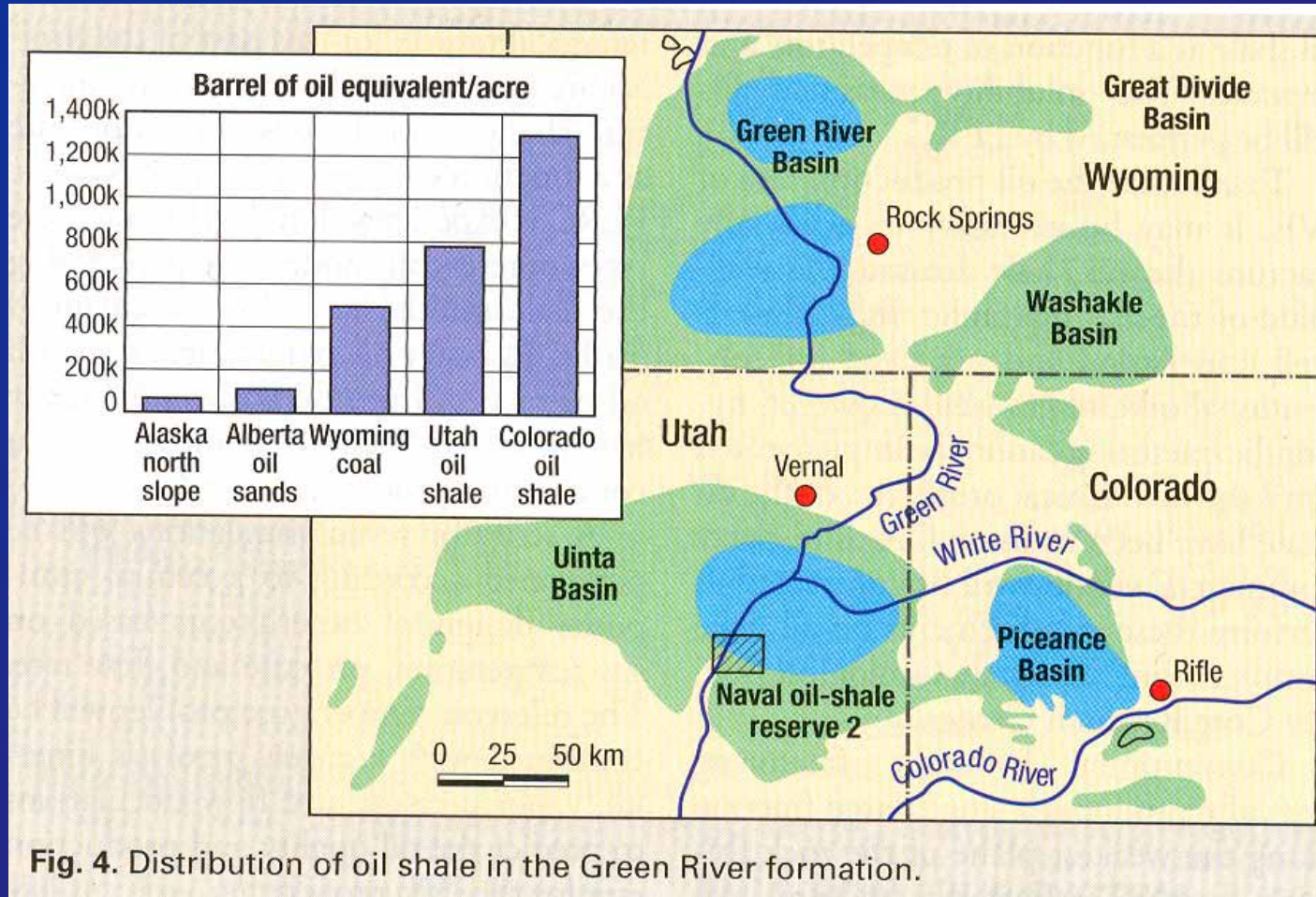


Three ice sheets, one covering most of Greenland and two covering Antarctica (separated by the Transantarctic Mountains), hold 99 percent of the ice that would raise sea levels if global warming caused it to melt or go afloat (the other 1 percent is locked up in mountain glaciers). The Greenland ice sheet lies almost entirely on bedrock and flows into the ocean roughly half as meltwater and half as glacial ice. In Antarctica most of the ice flows into the ocean from regions of relatively fast-moving solid ice called ice streams that drain the ice from slower-moving regions.



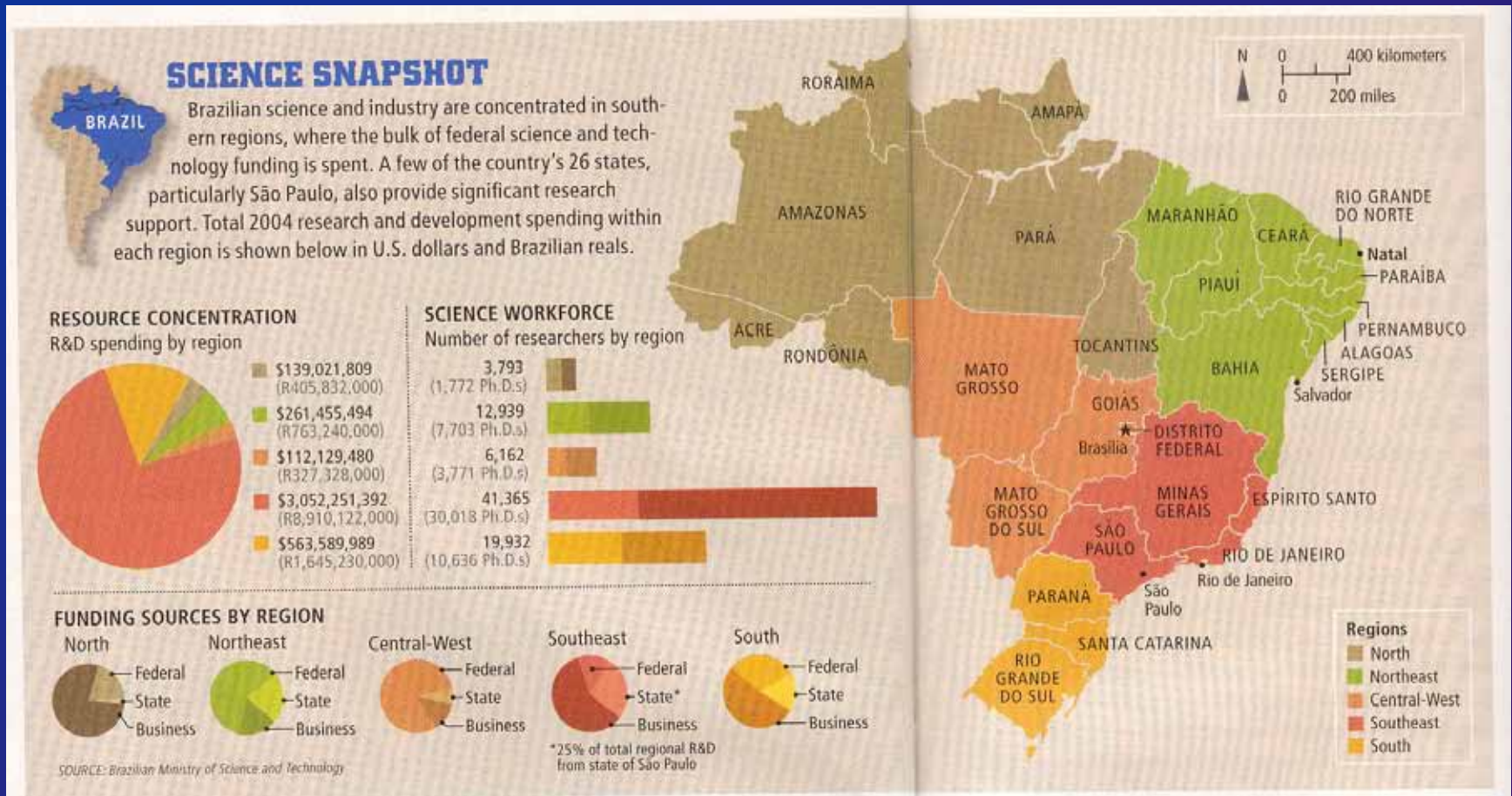
▲ Under the ice in Antarctica investigators have discovered an extensive network of lakes and rivers; the map above shows the "subglacial" positions of several such features. The Recovery lakes (inset at left), four subglacial lakes discovered by the author and designated A, B, C, and D, are the first lakes known to contribute to the start-up of a fast-moving stream of ice. The Recovery ice stream flows some 500 miles to the Filchner ice shelf.

Oil Shale in the Green River Formation



Single well, single gas phase technique is key to unique method of extracting oil vapors from oil shale
by K. Shurtleff and D. Doyle, World Oil, March 2008 v 229 n 3, pp118-127.

Regional Science & Industry

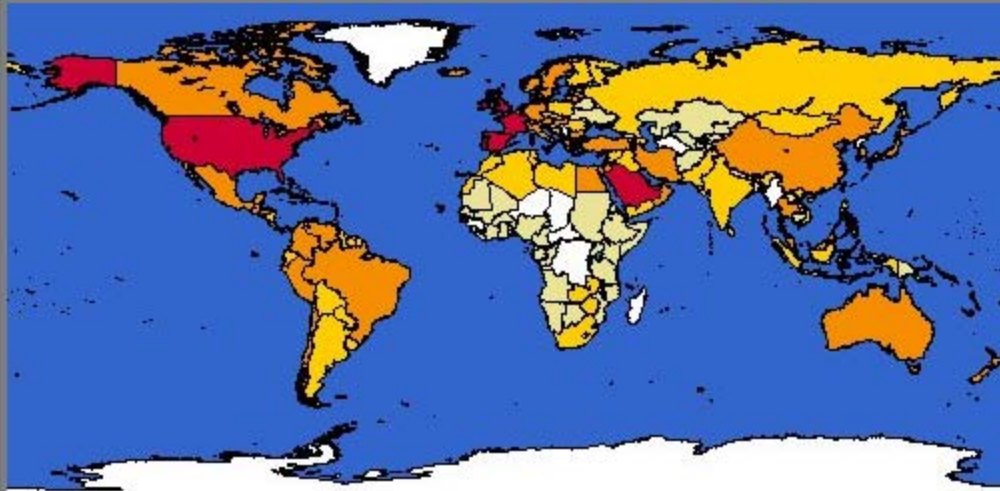


Building a Future on Science by Christine Soares,

Scientific American, Feb 2008, v298 n2, pp 80-85

Is Your PC Safe?

Virus Map



View: All Viruses

Select Map: Worldwide

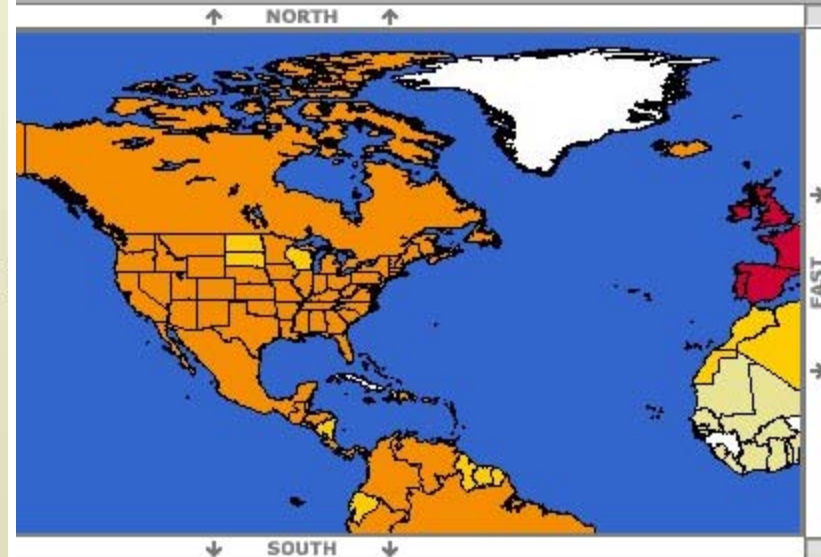
Track: Infected Computers/Million Citizens

On Click: Zoom In

Time Period: Past 30 Days

Last updated: Mar 13 2008 3:59AM Pacific Time

Legend: 0-1 1-10 10-100 100-1000 1000+



View: All Viruses

Select Map: North America

Track: Infected Computers/Million Citizens

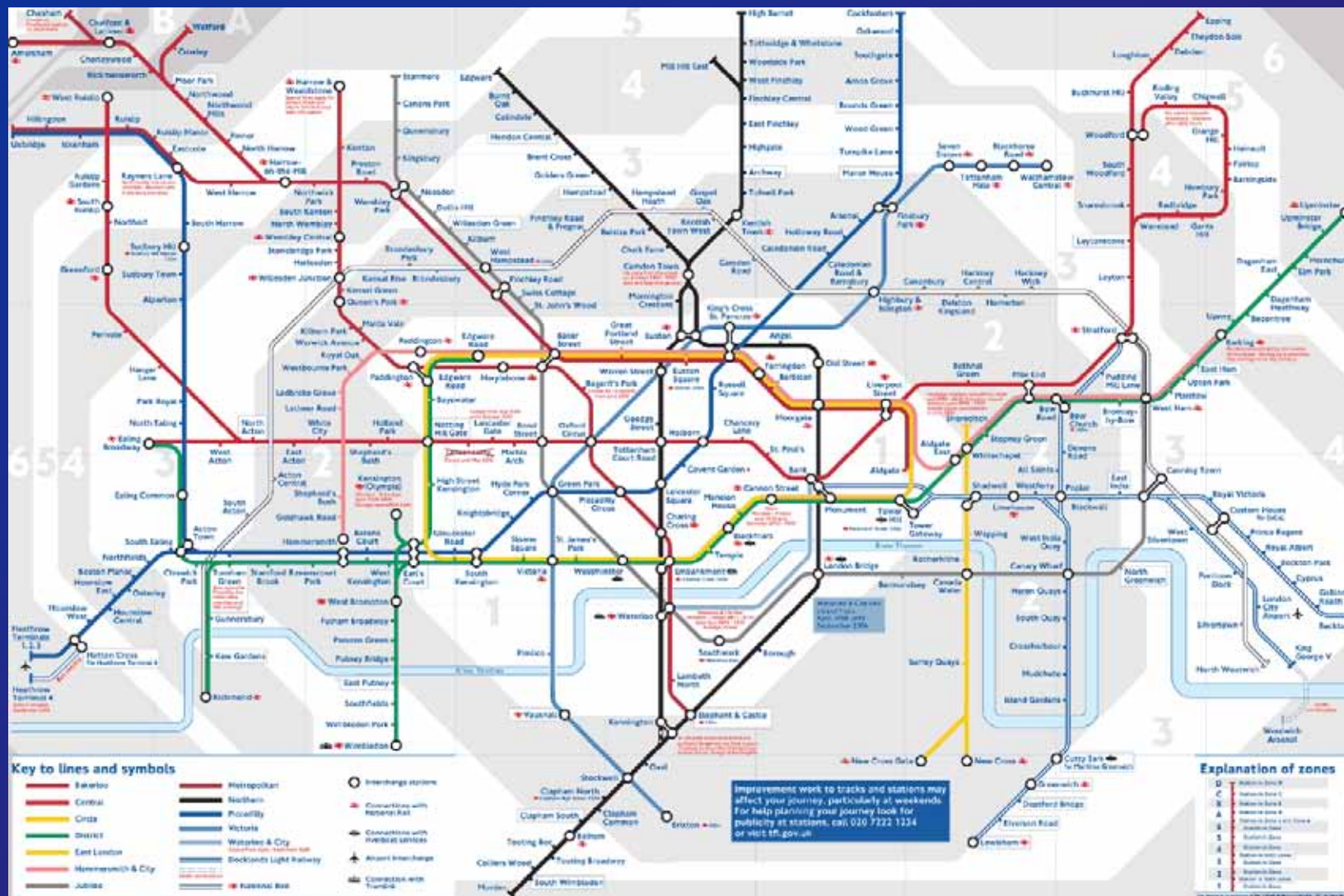
On Click: Zoom In

Time Period: Past 30 Days

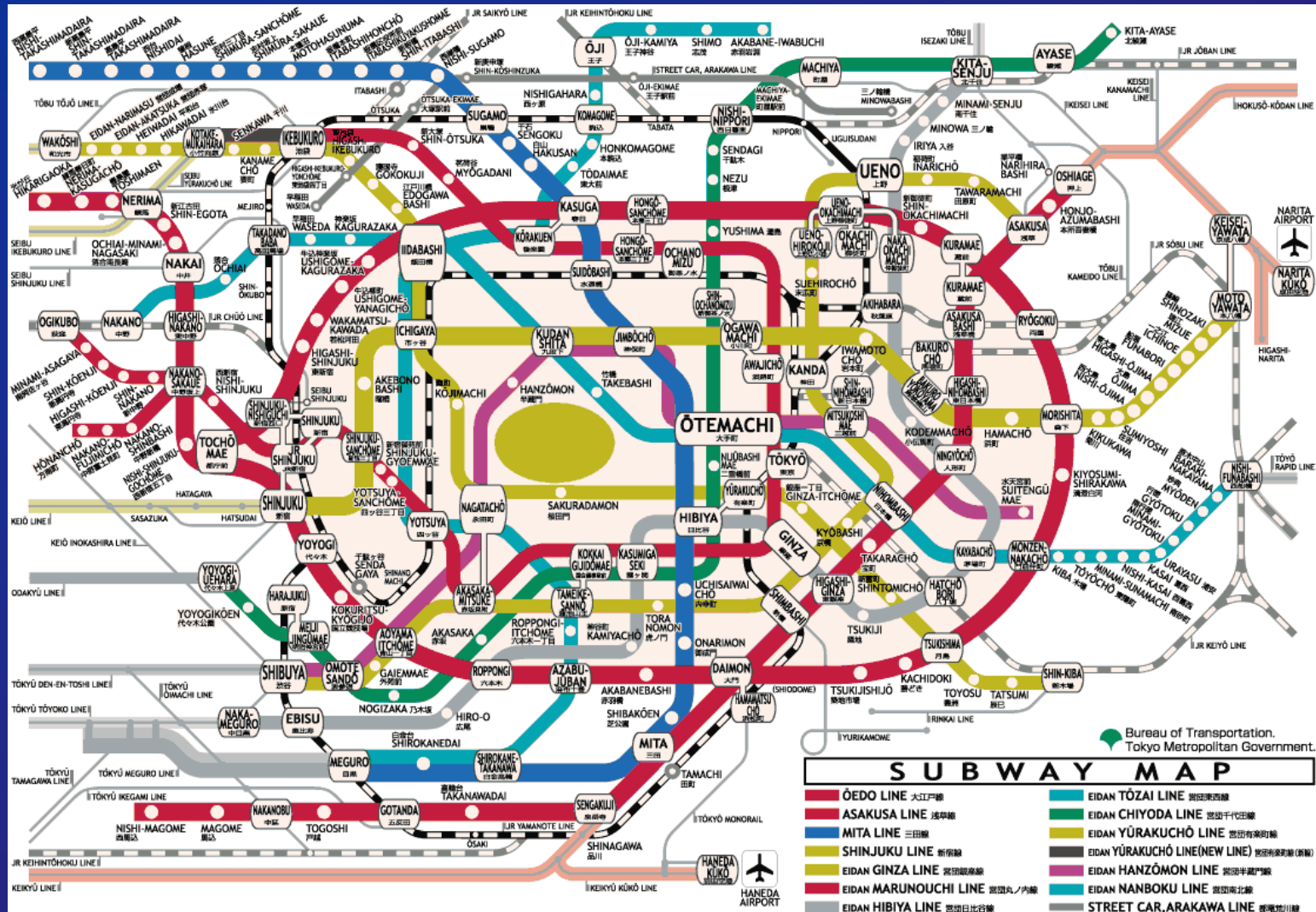
Last updated: Mar 13 2008 3:59AM Pacific Time

Legend: 0-1 1-10 10-100 100-1000 1000+

London Underground



Tokyo Subway





Correct Emphasis matters

ENVIRONMENT AND LEADERSHIP

Green and Not So Green

With the help of Yale and Columbia universities and LinkedByAir, NEWSWEEK compiled this index of environmental performance, which scores countries on factors including greenhouse-gas emissions, quality of water resources and habitat protection. A look at those nations that have excelled, and those lagging behind:

Leaders and Loafers COUNTRY/RANK

UNITED STATES

No. 66 Excellent water quality and sanitation, but reliance on fossil fuels means high emissions

SWEDEN

No. 1 Strong all around—terrific water resources and very low pollution and emissions



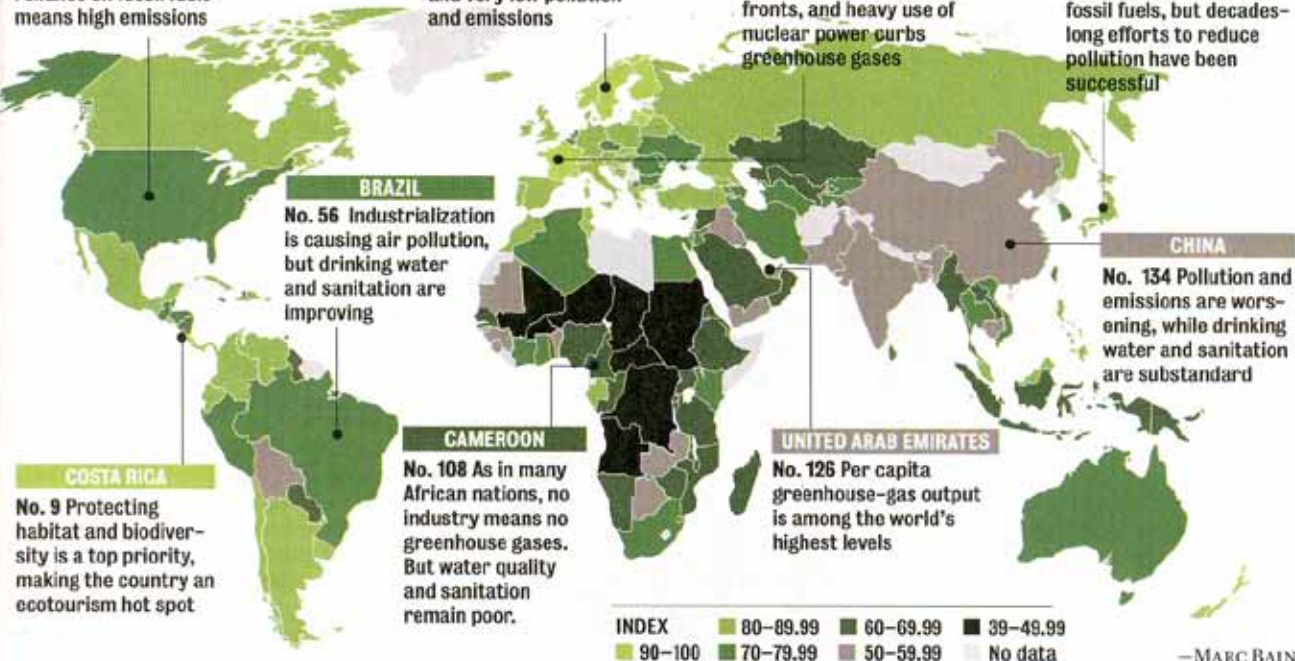
EMISSIONS-FREE: Parisians rent bicycles instead of cabs

FRANCE

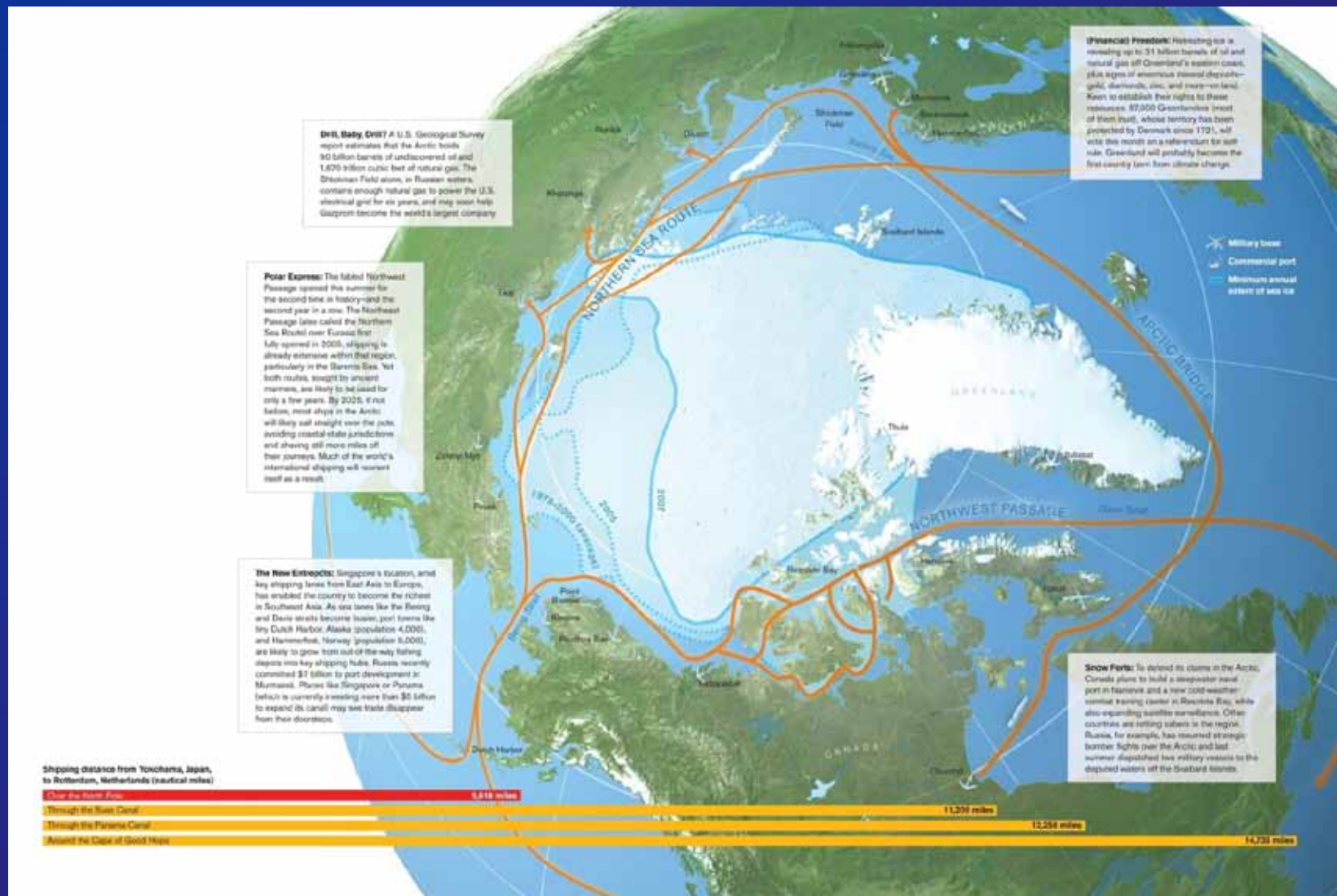
No. 7 Above average on all fronts, and heavy use of nuclear power curbs greenhouse gases

JAPAN

No. 27 Still burns some fossil fuels, but decades-long efforts to reduce pollution have been successful



The Point of View matters

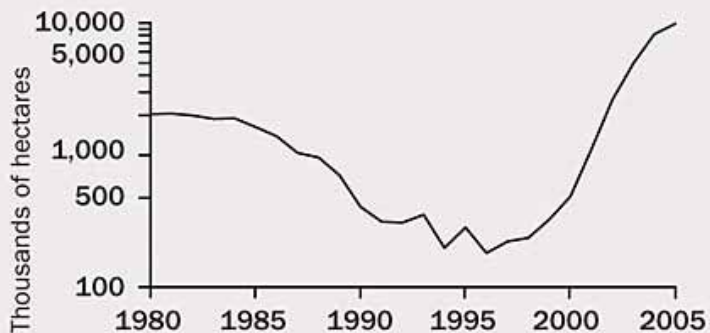


Strong Impact matters

Insect Infestation

Wood-boring beetles are devastating conifer forests across western North America. The map shows the locations of recent large-scale infestations by three species of bark beetles. The graph shows the total area affected by one species.

Forest area affected by mountain pine beetle



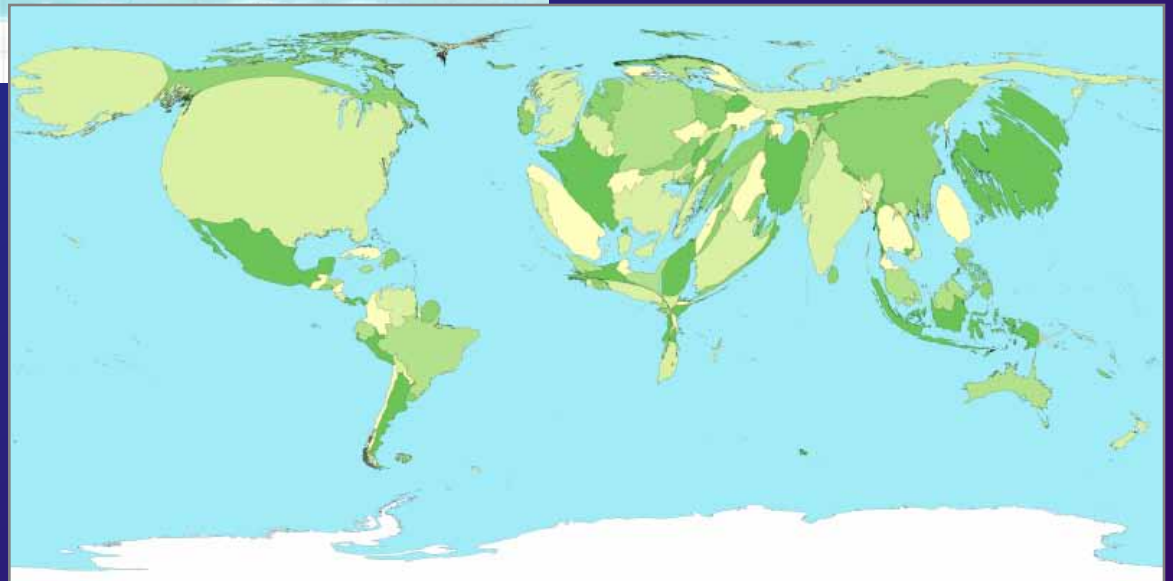
- Spruce beetle
- Mountain pine beetle
- Piñon ips beetle

Cartograms: Distorting the World?



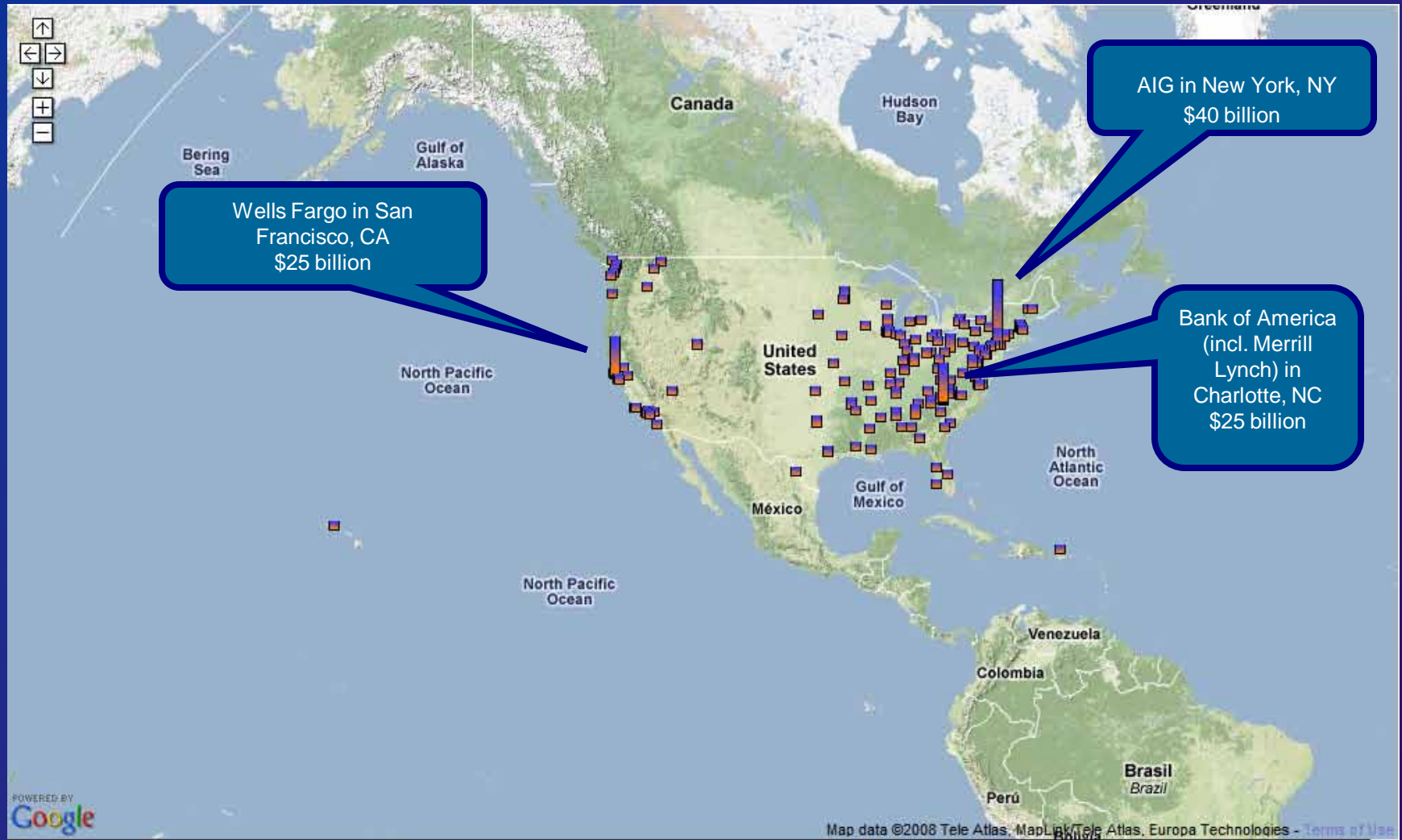
Normal view of the world

Cartogram of
Energy Consumption



By M. E. J. Newman; software available at:
<http://www-personal.umich.edu/~mejn/cart/>

Animation for Emphasis





Pandora's Box is Open

Mapping Sciences require ...

- Design Principles
- Design Factors
- Map Specifications
- Map Compilation
- Map Sheet Basics
- Production, Control, and Documentation

Acknowledgments

- PUG volunteers for years of service
- Fellow members of APSG for 6 years of volunteer service to educate industry
- EPSG, now OGP Surveying and Positioning, for “silverware” and continued industry leadership
- Allpoints for unlimited use of material and their cartographic passion



Web References

- <http://www.ogp.org.uk>
- <http://www.epsg.org>
- <http://apsg.garysmock.com>
- michael.barnes@cain-barnes.com