

A Nationwide Pollution Abatement Program for Lebanon, Using GIS Analysis

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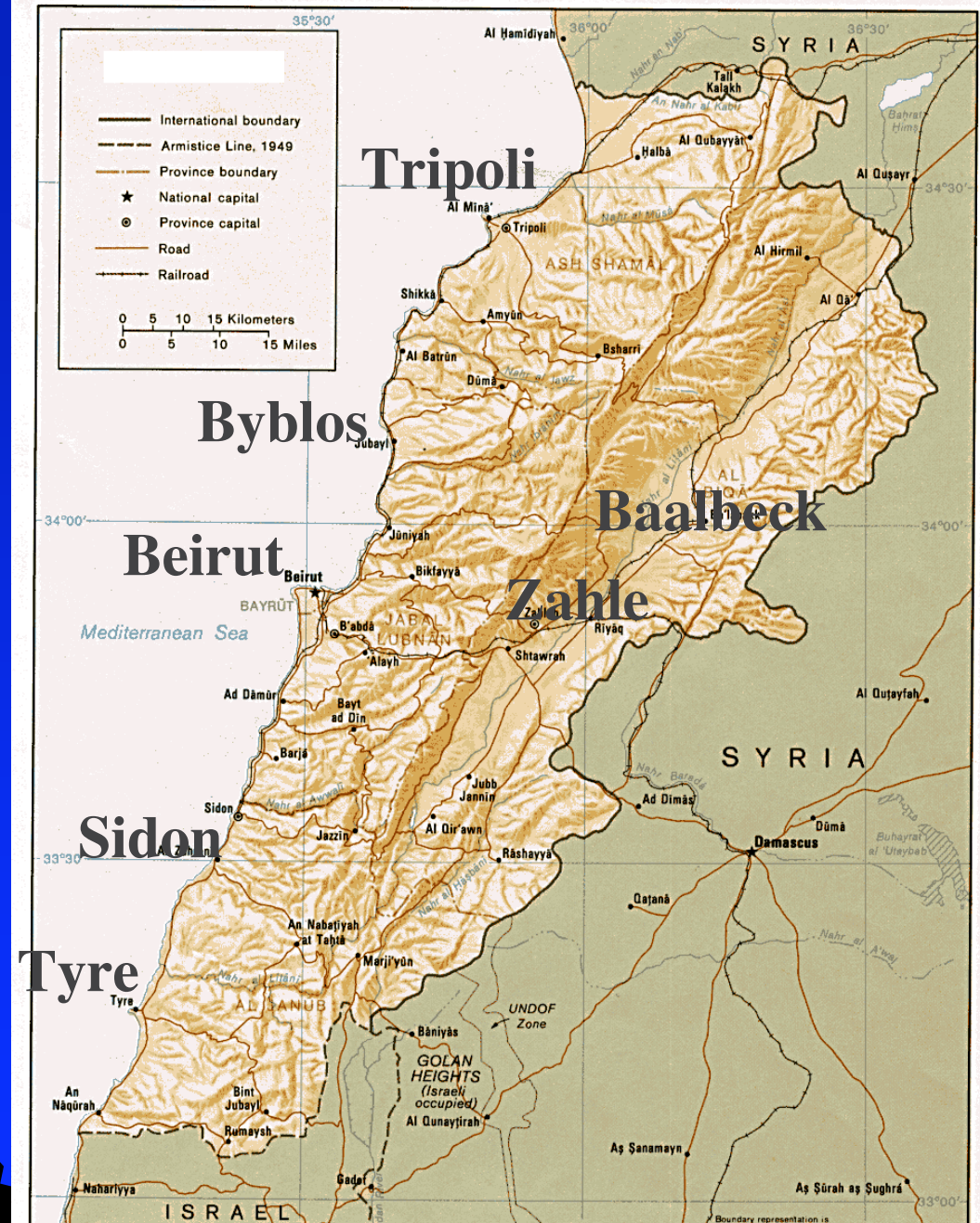
Speakers: Jacques Ekmekji & Basim Sayigh

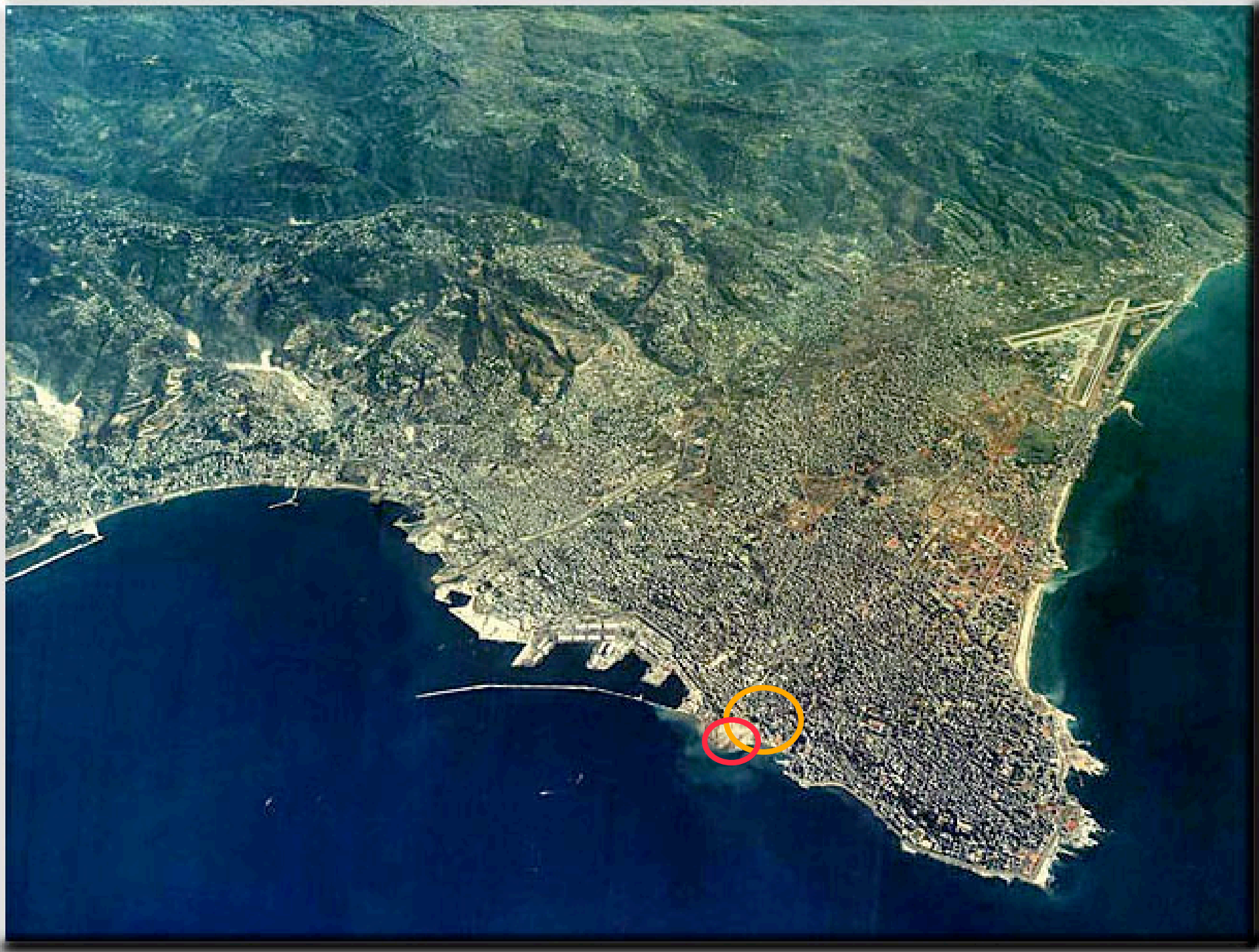
Sequence of Presentation

- The Setting
- Statement of Pollution Problem
- Addressing the Problem
- Why Geographic Information Systems (GIS)?
- Highlights of Conclusions & Recommendations
- Planning, Implementation, & Financing

LEBANON

- Mediterranean coast
- 140 miles of coast line
- 4030 sq. mile of rugged terrain
- Two mountain ranges
- Fertile Beqaa valley
- Narrow coastal plain
- Perennial water courses:
 - Litani, Hasbani, Orontes
- 68 major watersheds





Geological Structure/Groundwater Supply

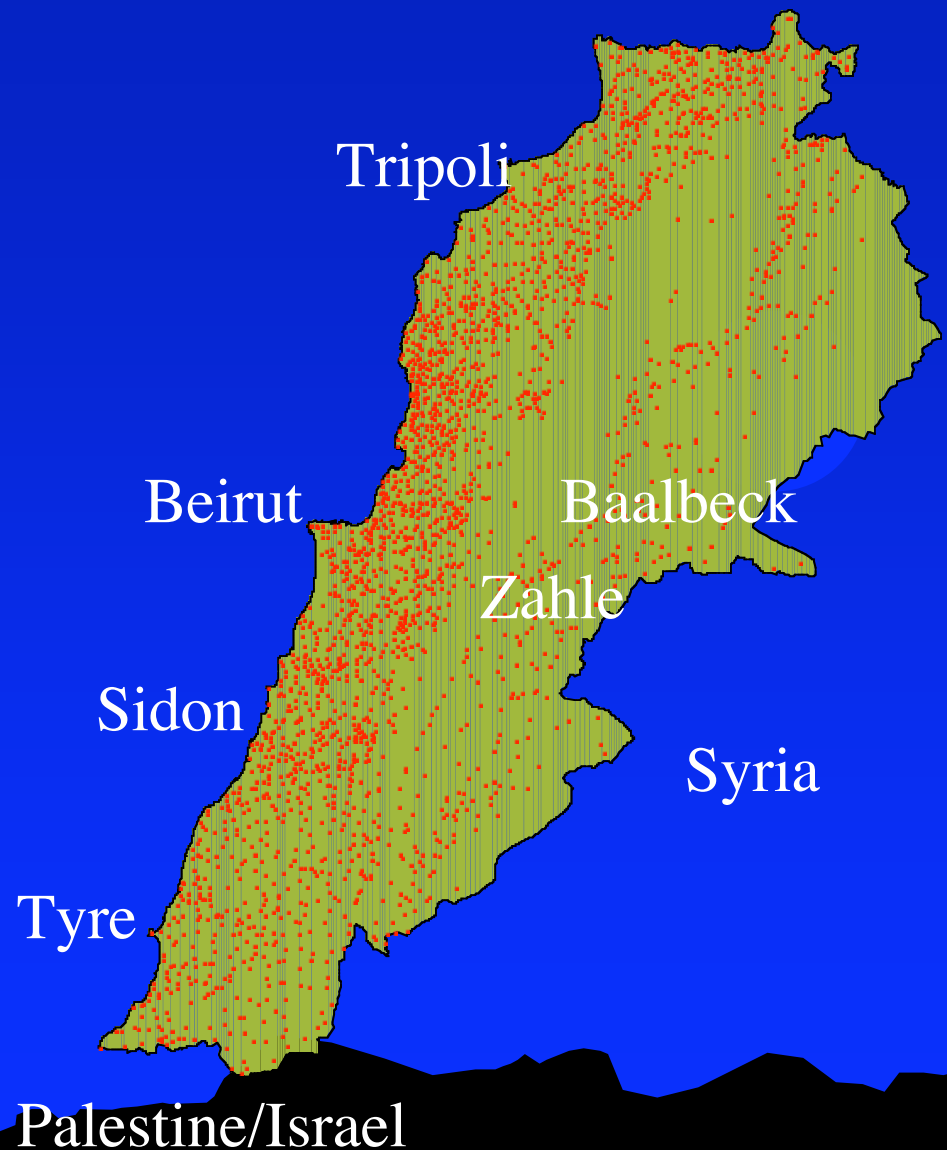
- Faulted & Contorted
- Deep beds of karstic limestone & dolomite
- Underground sources for potable water supply
- Replenished annually by rain and snow





Population Data

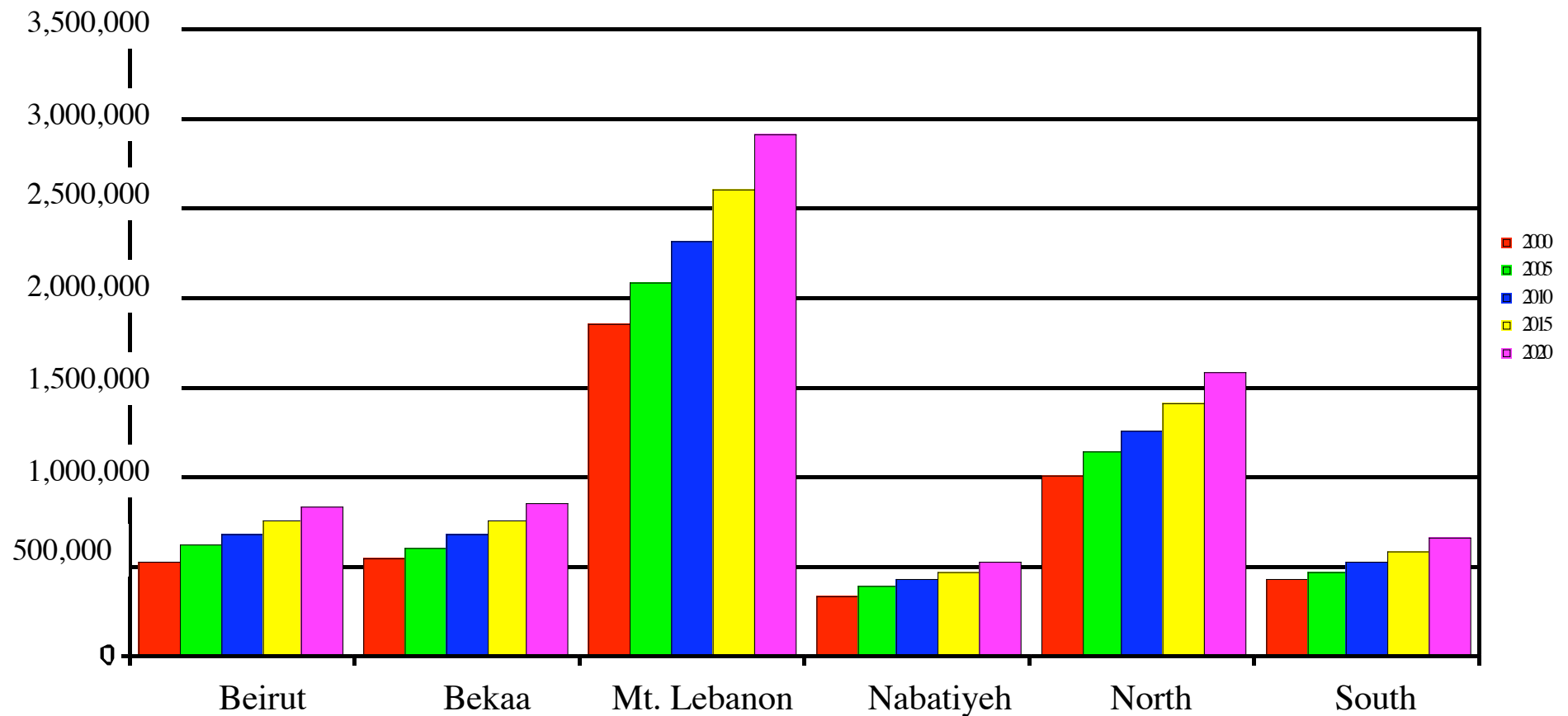
- National Census:
 - 1932 count: 785,770
 - No official census since
- Population Estimate:
 - 1970: 2,500,000
 - 1994: 3,300,000
- Projections:
 - 2005: 5,000,000
 - 2015: 6,600,000



Statement of Pollution Problem (General)

- Rapid Growth
- Crowded Cities
- Degradation of Environment:
 - Urban, natural, and shore-line conditions,
- Mass Migration & Displacement
- Increased Contamination & Health Problems
- No Effective Treatment & Disposal Systems
- Unrestricted Discharge
- No Single Environmental Management Controlling Authority
- Endangered National Well Being

Design Population Projections



Statement of Pollution Problem (Specific)

- No Treatment Plants
- Deplorable Collection Systems
- In-effective on-lot Disposal
- Aquifer Contamination



- **Uncontrolled Combined Sewer Discharge across the Beaches;**
- **Ineffective Main Outfall;**
- **Over Pumping of Coastal Boreholes;**
- **Sea Water Intrusion;**
- **Fertilizers, Pesticide, & Industrial Discharge.**



HELP



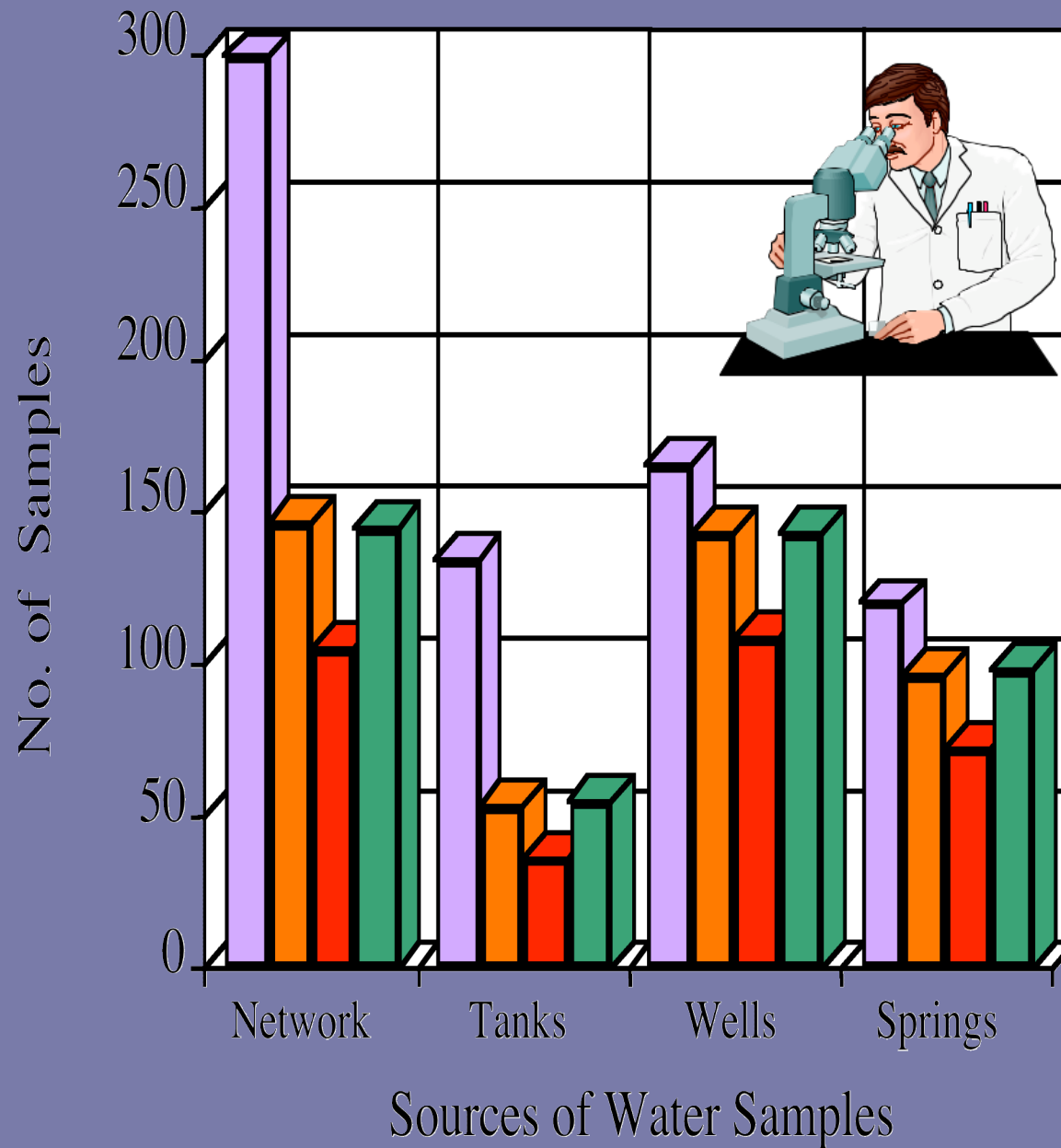
HELP

Statement of Pollution Problem (Public/Community Health)

- Clear Connection and Trends Linking;
 - Ground Pollution;
 - Drinking Water Quality;
 - Community Health.

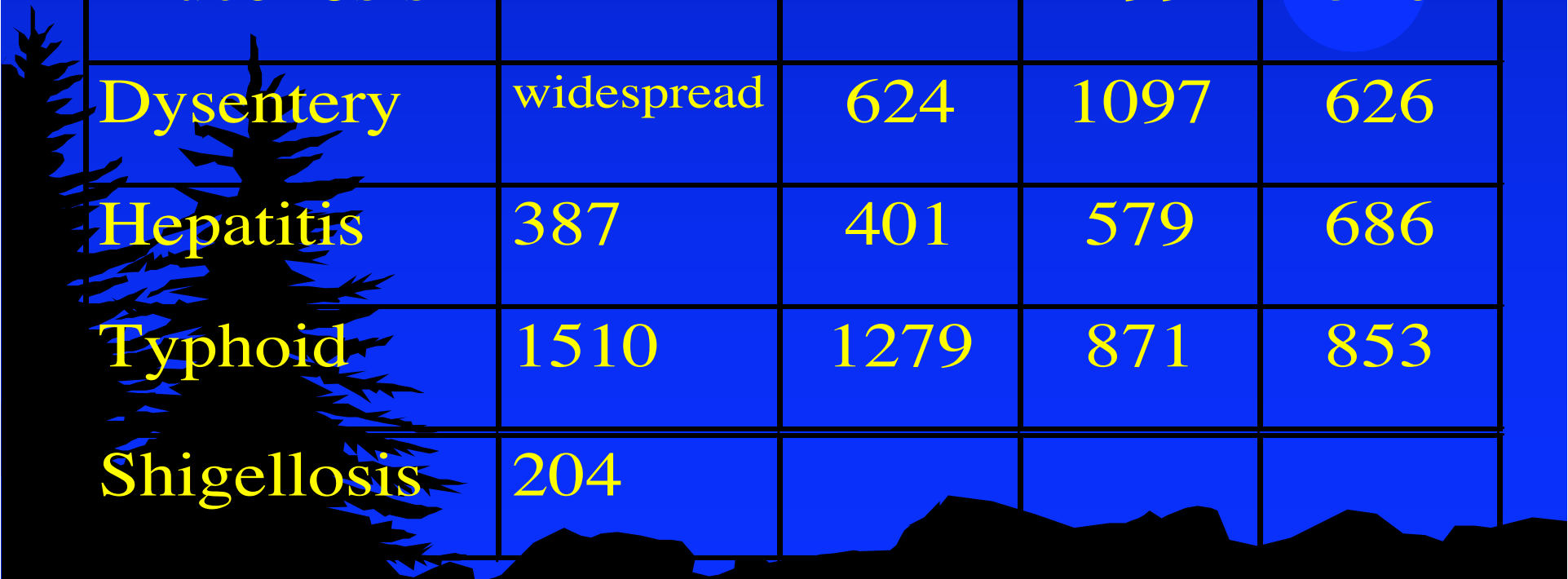


- Increased Pollution of Wells, Springs, and Beaches.



- Total No. of Samples
- No. of Polluted Samples
- No. Polluted by E. Coli
- No. Polluted by Coliform

Summary Health Report



Reported Diseases	AUB 1982	MoH 1995	MoH 1996	MoH 1997
Brucellosis		241	299	316
Dysentery	widespread	624	1097	626
Hepatitis	387	401	579	686
Typhoid	1510	1279	871	853
Shigellosis	204			

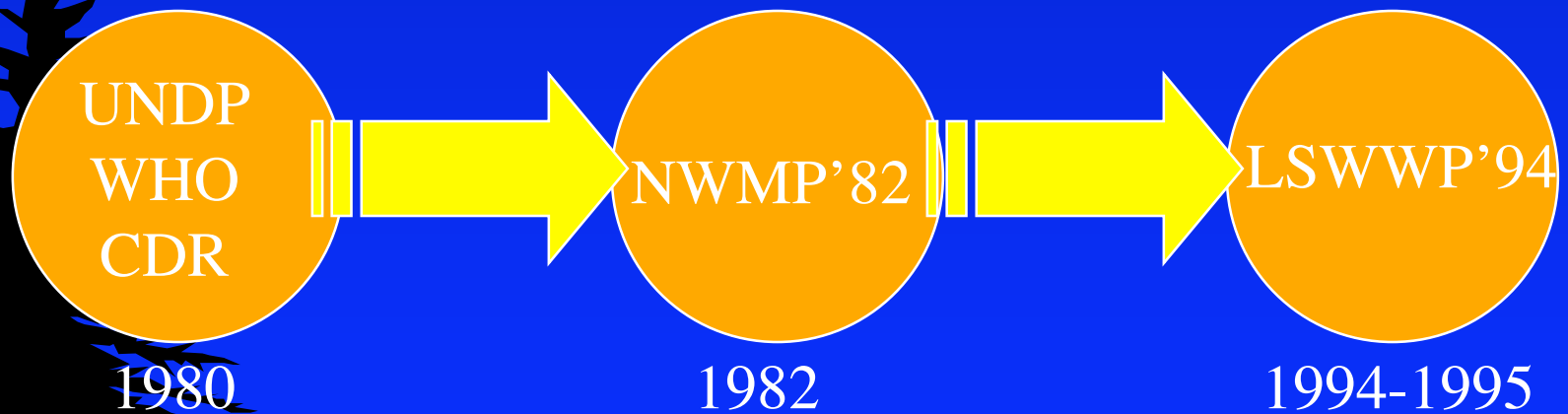
American University of Beirut (AUB) founded 1866

Addressing The Problem

→ Development of A National Wastewater Management Program

1975

16 Years of Devastation



Addressing The Problem

→ Development of A National Wastewater Management Program

Lebanon's Staged Wastewater Program

LSWWP'94

1994-95

- A National Wastewater Management Program
- Developed by Updating and Modifying the NWMP'82
- Responds to the Prevalent Pollution Problems
- Reviews Design Criteria in light of recent
 - Environmental Knowledge
 - Wastewater and Material Technology
 - Construction Techniques, and
 - International Standards.

Addressing The Problem

→ Development Of A National Wastewater Management Program



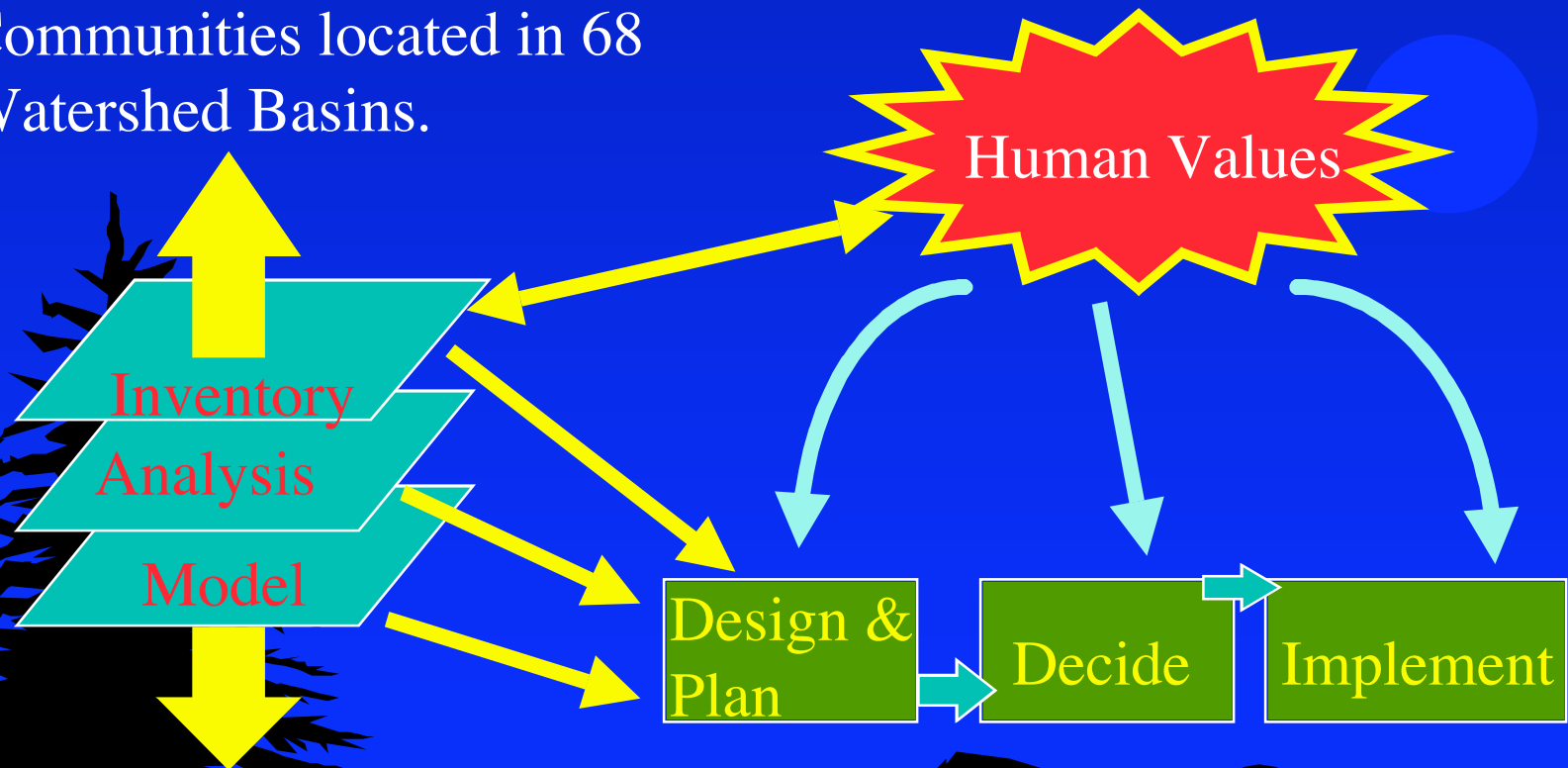
LSWWP'94

1994-1995

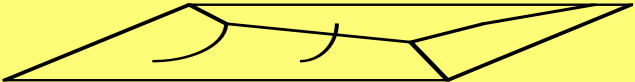
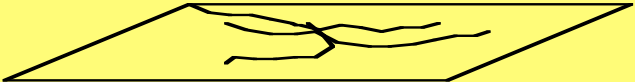





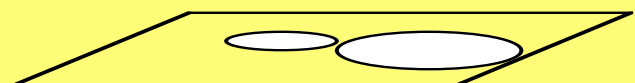

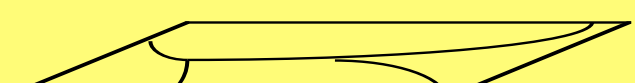
- Establishes Guidelines for Planning & Design of:
 - Wastewater Collection
 - Conveyance
 - Treatment and Disposal Facilities.
- Sets the Foundations for a Nationwide Wastewater Management Plan
- Utilizes Geographic Information Systems (GIS) Technologies as an appropriate technology
- Develops an Implementation and Capital Investment Plan.

- Document Existing Conditions;
- Analyze Needs;
- Generate Conceptual Plans and Programs for more than 1,600 Communities located in 68 Watershed Basins.

Why GIS?



Think about our Reality in Ways we haven't
been able to in the Past

	Roads	Line	Highways Principal Roads Secondary Roads Paths / Other
	Rivers	Line	Permanent Temporary Canals
	Watershed Basins	Polygon	Watershed Outline
	Sewer Network	Line	Sewer Network (1982)
	Sewer Facilities	Point	Treatment Plants Pump Stations
	Sewage Outfall	Line	Sewage Outfall Locations
	Cities, Towns Villages	Points	X,Y Coordinates, Population, Elevation
	Sewer Boundaries	Polygon	Boundaries of Areas Served by Sewer Network
	Political Boundaries	Polygon	Boudaries of Kada, Mohafaza, Intl. Boundary..
	Land Cover / Use	Polygon	FAO Classifications (See Attached Sheet)

GIS Analysis

- Setting Minimum Population Level for use in the Study
- Determining Total Population
- Use 3D Representation to visualize the Terrain (DTM)
- Determining Proximity of Cities to Existing Wastewater Networks
- Developing “What if” Scenarios
- Proposing Wastewater Disposal Methods
- Proposing Location of Wastewater Lines
- Generating High Quality Maps.



Scale 1: 1,362,408

188,602.78
210,738.05

zoom all

New



Views



Tables



Charts



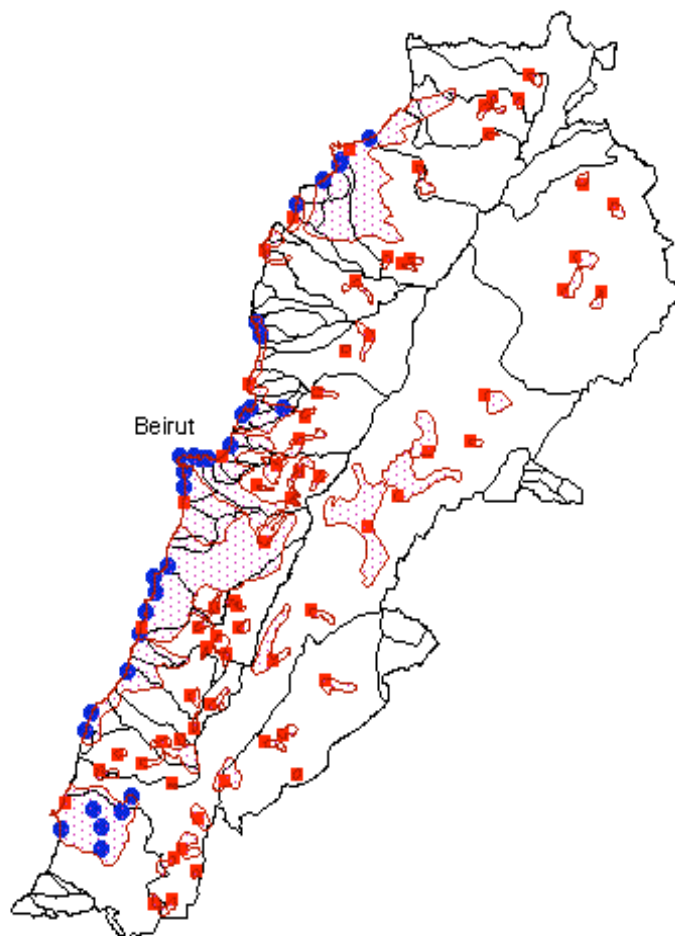
Layouts



Scripts

- ☒ Sewerb
- ☒ Sewerpt
 - Pump Station
 - STP
- ☒ Basins

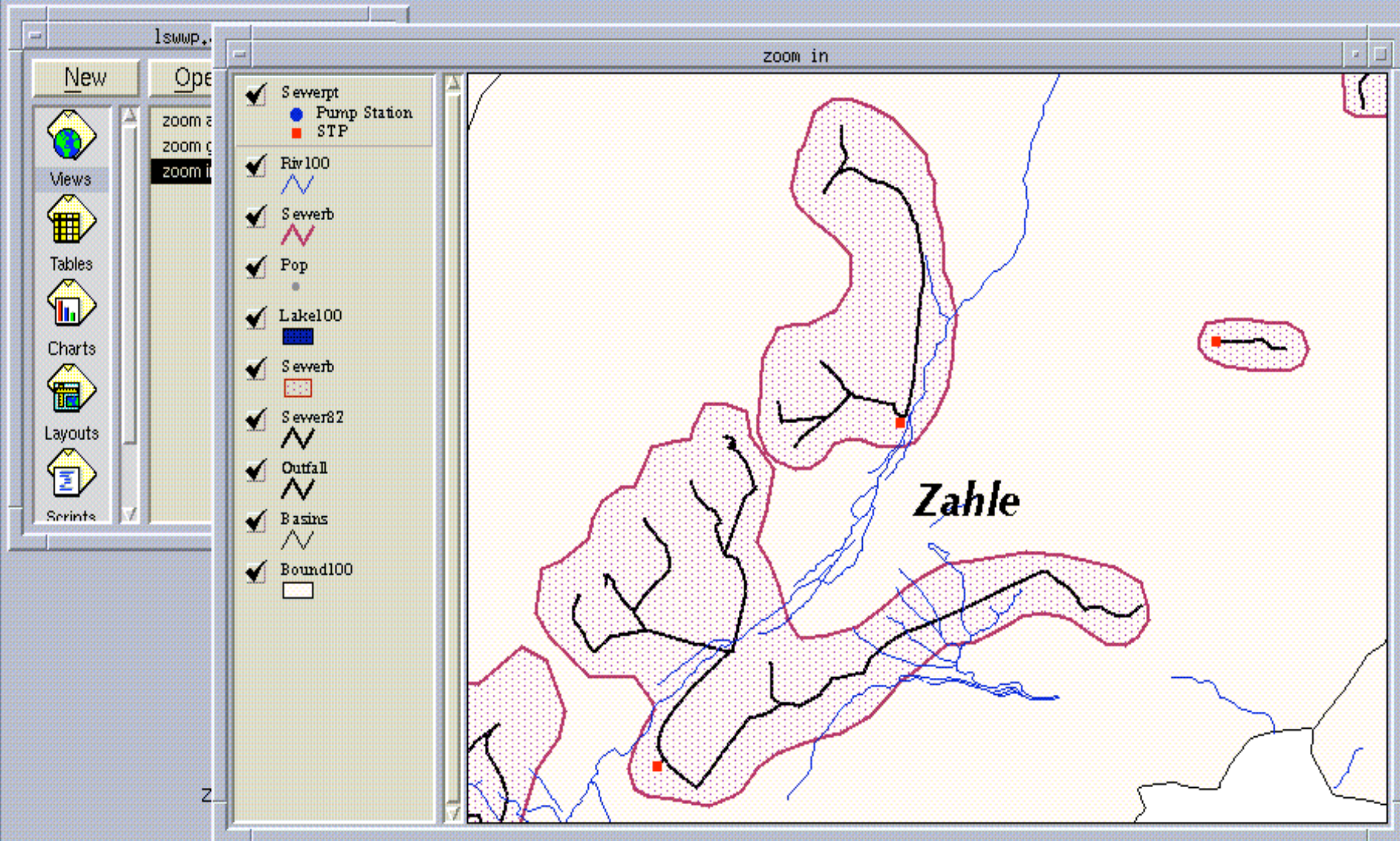
Beirut



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Scale 1: 136,257

182,371.05
218,330.06

Highlights of Conclusions & Recommendations

Number	Required Wastewater Facilities
6	Regional Collection, Conveyance, and Treatment Systems
4	Sea Outfalls for the Regional Systems
1	Rehabilitation and Extend Regional System and Sea Outfall and add Treatment
2	Coastal Sub-regional Collection and Treatment Systems with Outfall
3	Inland Regional Collection, Conveyance, and Treatment Systems
4	Inland Sub-regional Collection, Conveyance, and Treatment Systems
37	Single Inland Community Collection and Treatment Systems
1	Pilot Scale Demonstration Treatment Facility
1	Operations and Maintenance Training Center

Implementation, Planning, & Financing

- The future well being of the entire national community, including its tourist industry and the sustainability of development, is endangered.



But there is hope

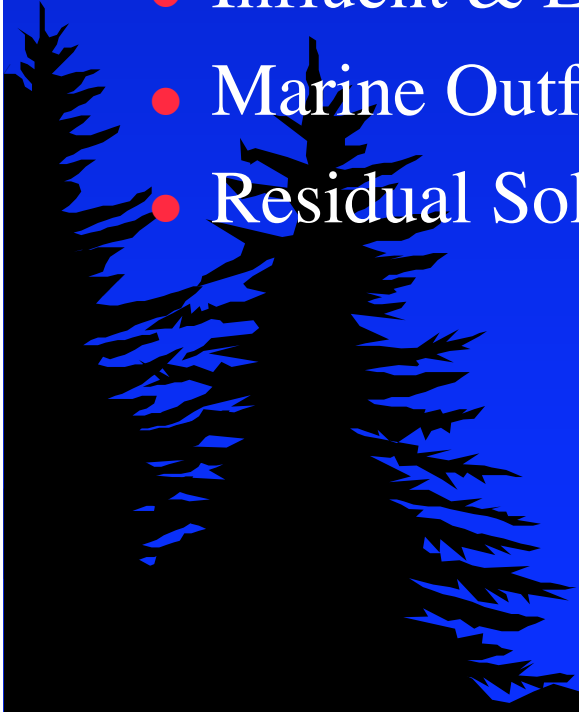
Realization of the need to visualize, plan, and finance environmental management, in Lebanon, is now gaining ground.

Planning, Implementation, & Financing

- Justification for the large investment needed rests mainly upon public awareness of:-
 - Adverse impact of prevailing conditions on community health
 - Prospective growth of risks and related costs associated with failure to take timely and effective action.
- LSWWP addresses engineering and environment, construction and cost, operation and maintenance.
- Implementation schedule extends from 1995-2006
- Estimated construction cost: **US\$ 3.05bn;**

Planning, Implementation, & Financing

- Costliest & Most Critical Components are:
 - Coastal Treatment Plants
 - Influent & Effluent Pump Stations
 - Marine Outfalls, and
 - Residual Solids Disposal Facilities.



Setting Financial & Institutional Framework

- **CDR**: Council for Development & Reconstruction
- **PMU**: Program Management Unit @ CDR (EC)
- **Ministries**: MHER, MoE, MMRA
- **SIUs**: Sector Implementation Units @ Ministries (EC)
- **OMAR**: Office of the Minister for Admin. Reform (USAID)
- **MSCs**: Management Support Consultancy (30M ECU)
will replace PMU & SIUs
- **NEC**: National Environmental Council
- **Env. Code**: Environmental Code (in the Parliament)

Progress Towards Physical Implementation

● **NCSR: National Center for Scientific Research**

- Environmental Monitoring and Database through Remote Sensing of Marine Operations (UK)
- Resource, Quality and Management of Water - Application in the Akkar Region (Francophone CEDRE)
- Program of Al-Kabeer River Basin - Management of an Int'l Border Watershed (Canada & Syria)
- Program of training workshops on Environmental Information Systems, GIS, and Remote Sensing (DSE Germany)
- Management, Protection and Sustainable use of Groundwater and Soil from Contamination (ACSAD & German BGR)
- Assessment of Natural Resources in the Karstic Coastal.

Progress Towards Physical Implementation

- **Rehabilitation**
- **Ghadir Pre-treatment**
- **Several projects in Beirut and major cities are under construction**
- **Efforts to comply with “Mediterranean Regional Pollution Control Protocol”**
- **NGOs exerting pressure on government to take drastic measures.**

Interest of International Funding Agencies

- **European Investment Bank**
- **European Community**
- **The World Bank**
- **Country Protocols (France, Germany, Italy, Sweden);**
- **Saudi & Other Arab Funds**
- **USAID/USTDA (Assistance includes funding of AUB Environmental Lab. & Institutional Modernization)**

Opportunities for Foreign Business

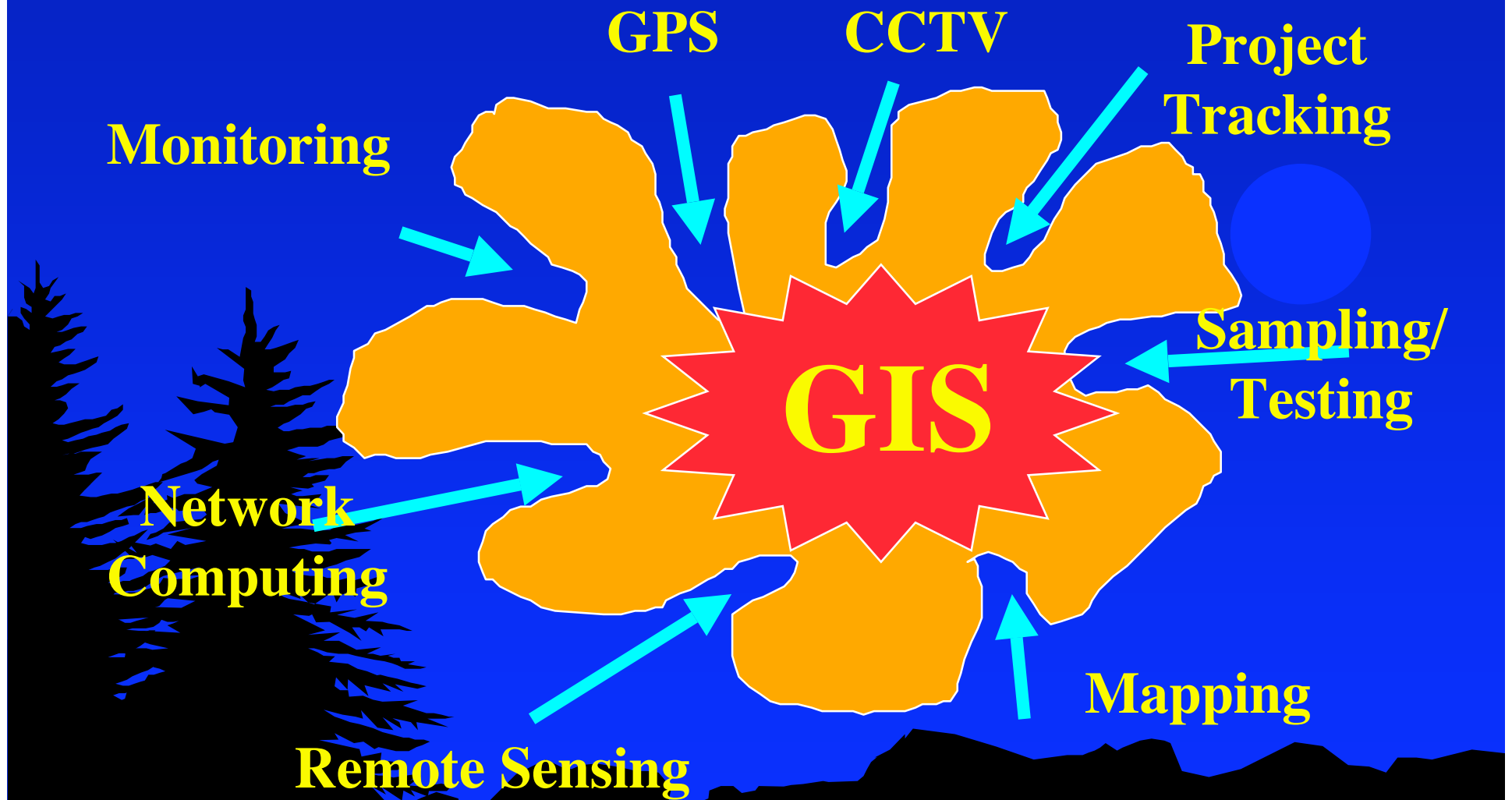
- **Standardization/Unified Policy (LIBNOR)**
- **USAID, USTDA, EX-IM Bank, Dept of Commerce**
- **Despite the ban 1985-1997, trade with the US remained the highest** (Material & Supply with local Reps)
- **Market Potential:**
 - Engineering/Specialty Services
 - Construction Management
 - Monitoring
 - Institutional
 - Privatization
 - Industries
 - Equipment
 - HW/SW/NT

The Integrated Management Approach

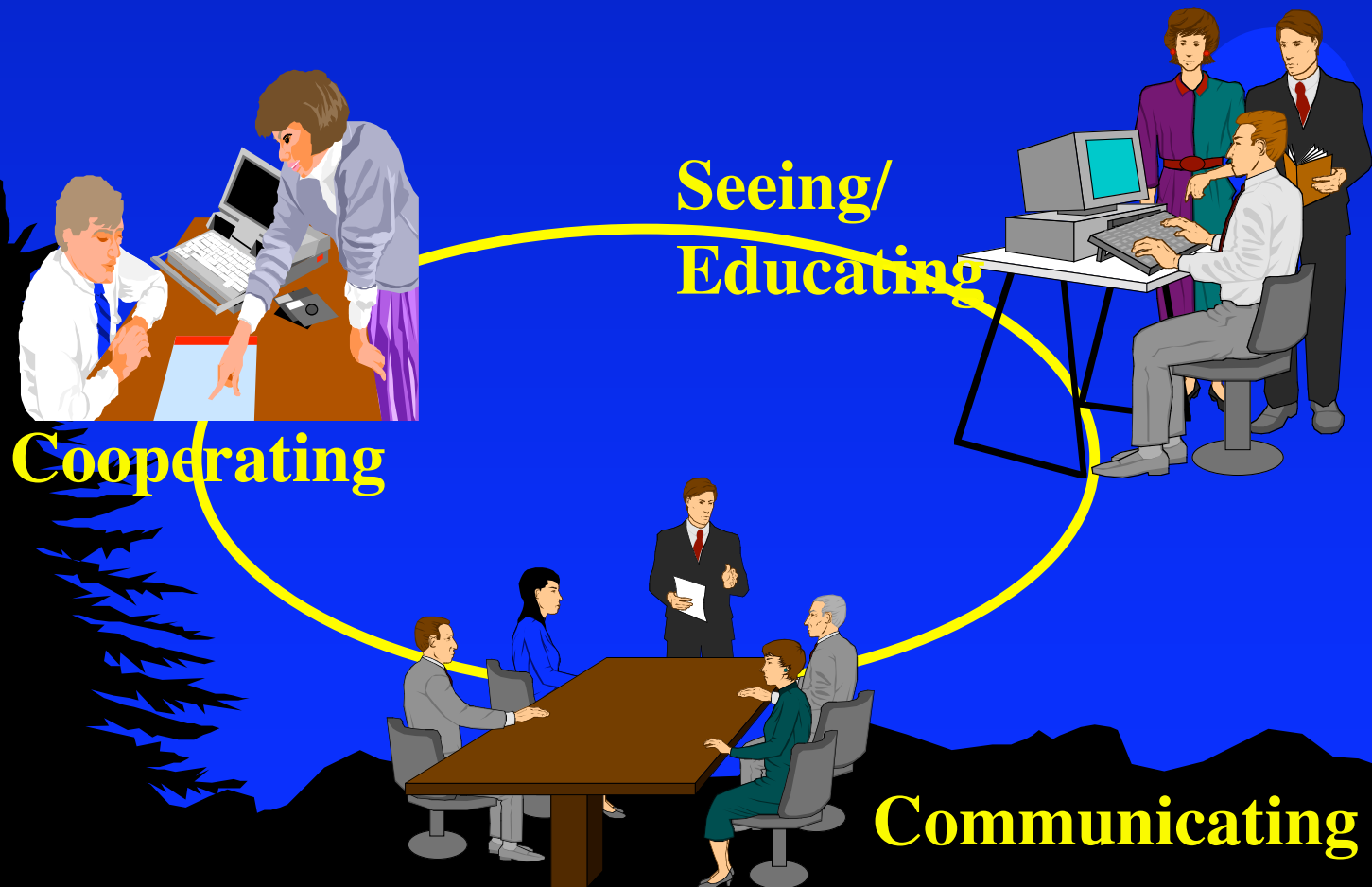
- Looking holistically to the entire Water Cycle with focus on:
 - Protection
 - Conservation
 - Reuse
- A National-International Will to the Rescue
- GIS for Support



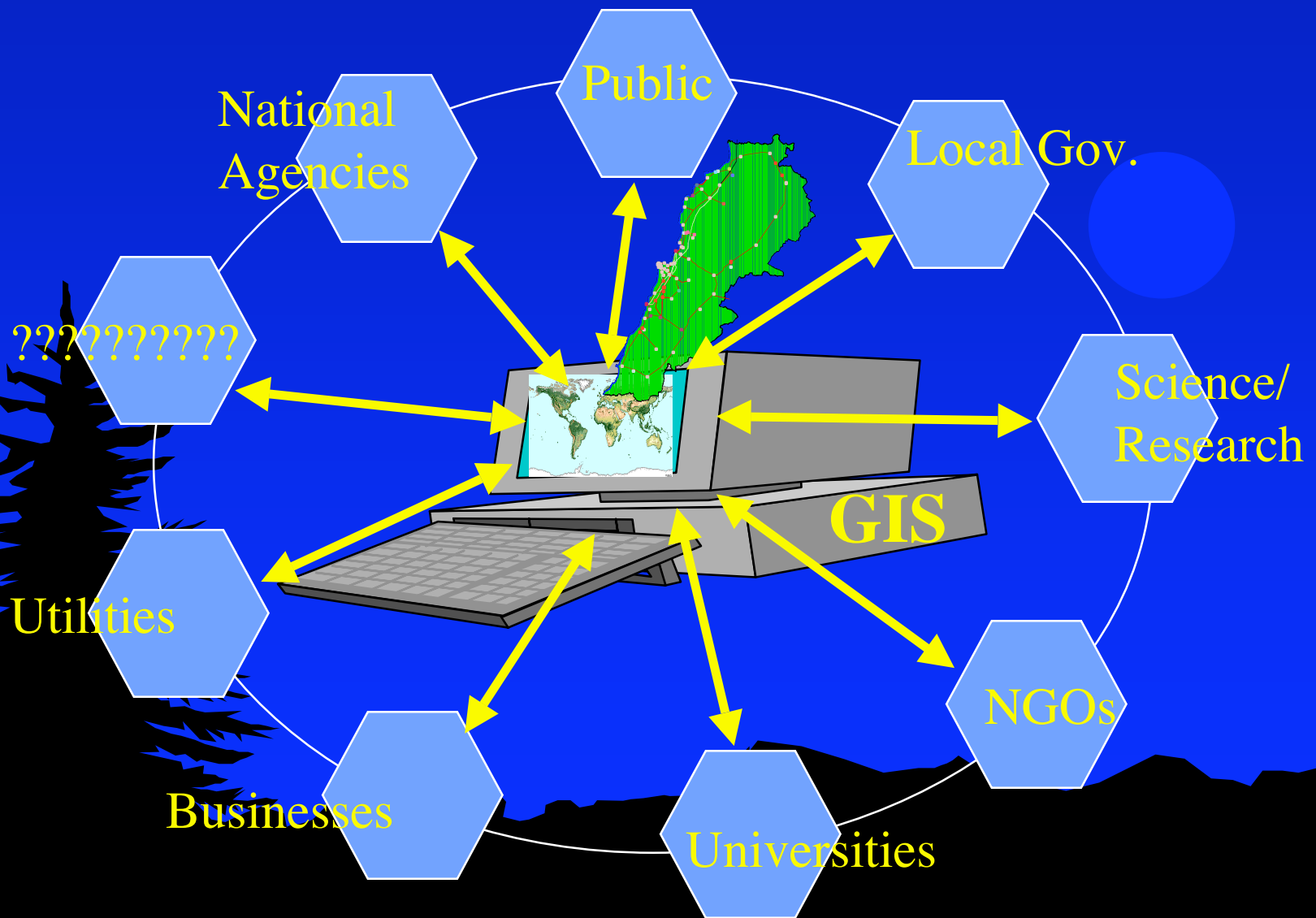
Converging Technologies



GIS is a Common Visual Language



GIS provides a common framework for cooperation



Shared Information



=

Shared Vision



GIS is more than a
Technology, it is a
whole new working
environment.

Thank You for Your Attendance and Your Attention

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QUESTIONS are Welcome