Geog 464 Learning Objective Outline

LOO 22 Challenges with Linked Analysis between Programming and Implementation

22.1 What role does GIS-based modeling play in linking programming to implementation?
22.2 What workflow process is needed to address impacts in detail?

22.1 What role does GIS-based modeling play in linking programming to implementation?
RUGIS Chapter 13 Section 13.2

Let's compare the modeling effort across the three decision situations, given six units of work effort for a budget (six units of time). **See Table 13.1**. How would you distribute the units across each of the decision situations to come to know about what do to in that decision situation? Each entry in a cell is the number of units to be practically adequate at that stage, given the context of the work situation. The "effort budget" of six units is never enough – but that is the way it always seems to be if we followed the adage.... "If we only had twice the time, we would be able to be twice as effective, delivering an information product that is twice as concise." (Gerald VanBelle, UW Environmental Health)

In light of the previous section, improvement programming analysis is about selecting projects to be budgeted in the current round of consideration based on existing conditions. As mentioned earlier, a major component is on budgeting, but other criteria are considered as well, particularly in regards to a projects "impact" on the world.

The **link between programming-focused work and project implementation-focused work** might best be **understood in terms of the "impact model" phase of modeling**, but remember the link between decision situation work really comes through all phases. However, to be practical let us focus on the impact modeling. What impacts might we consider – see Table 13.2 and 13.3 in text.

See Table 13.2 about social impacts that might be considered in a project-level impact assessment for an integrated watershed management.

See Table 13.3 about an elaborate set of characteristics, conditions, and factors for **environmental impact assessment** associated with habitat restoration.

The number of criteria used depend on the context of the assessment to be performed.

22.2 What workflow process is needed to address impacts in detail?
RUGIS Chapter 13. Section 13.2

There are a few key types of Environmental Assessment that can be used to provide an understanding of the difference between a program-level assessment and a project implementation-level assessment; Sadler (1996) identifies, and Heathcote (1998) summarizes four key types of environmental assessment, although given the wording we should **generalize** this to simply "assessment":

1. Strategic environmental assessment (SEA) – process of prior examination and appraisal of policies, plans, and programs and other higher-level or pre-project initiatives.

2. Environmental assessment (EA) – systematic process of evaluating and documenting information on the potential, capacities, and functions of natural systems and resources in order to facilitate sustainable development planning and decision making in general, and to *anticipate and manage the adverse effects and consequences of proposed undertakings in particular.*

3. Environmental impact assessment (EIA) – a process of identifying, predicting, evaluating, and mitigating the biophysical, social, and other relevant effects of proposed projects and physical activities prior to major decisions and commitments being made

4. Social impact assessment (SIA) – process of estimating the social consequences that are likely to follow from specific key policy and government proposals, particularly in the context of national EA requirements.

The above four types of assessment are in some sense a matter of "workflow details" – which is how we differentiate the programming-level assessment from the project implementation-level assessment.

Within the context of Heathcote's (1998) discussion of integrated watershed management, environmental assessment often includes three phases, preliminary (simple) assessment, detailed assessment, and follow-up.

- Preliminary assessment is used to determine whether a project is covered by EA legislation or policy, whether an EIS is required, the necessary nature and extent of the EA process, and scoping.
- Detailed assessment includes analysis of impacts and mitigation necessary for the "do nothing" option.
- Follow-up includes monitoring and audit functions to determine the actual impacts of the project and ensure that mitigation measures are in place.

We can further characterize the difference in a programming-level and implementation-level assessments using the Steinitz 6 phases of modeling in Table 13.1. A programming-level analysis performs a simple assessment. A preliminary assessment would focus on phases 1, 3, 4, and 6 of Steinitz et al. (2003) phases of modeling (values describe options and evaluate options that feed the decision model in phase 6). The detailed assessment incorporates 2 (nuanced process) and 5 (impacts). Follow-up is the check on those impacts, that is, the monitoring about "what really happened?"

Legally speaking, according to state and federal law, an EIS is performed only when 1) state money or federal money, respectively, is involved, and 2) a full EA is determined to be necessary because the impacts that have been identified are "significant". When a preliminary EA is performed the phrase "**determination of non-significance**" is used to describe the resultant nature of impacts.

The full detailed) impact assessment – **an EIS** - of the natural and/or human activities on the environment requires an extensive knowledge of direct or indirect effects from different factors, and possible consequences. Using detailed GIS information for project implementation (scope, design and build) is still somewhat of a technical challenge, because of the lack of knowledgeable people to put GIS to work in sophisticated and nuanced ways that incorporate multiple scale perspectives for both space and time.

Table 13.1. Comparing Planning-, Programming-, and Implementation-Level GIS Work in Terms of Generalized Units of Effort Involved (1–3 Units) for Each Phase

Phase in the Steinitz framework	**Planning**	**Programming**	**Implementation**
Representation model	2	2	2
Process model	1	1	2
Evaluation model	1	1	2
Change model	1	2	2
Impact model	2	1	2
Decision model	2	3	2

Table 13.2. Sample Categories for Social Impact Assessment. From US Army Corps of Engineers (2009)

Indicators/Impact Measure	**Evaluation Criteria**
Residential Rate Increases	Residential Rate Increase >5 percent Residential Rate Increase <5 percent
Rate Employment Impacts	Decrease in Employment >1 percent Decrease in Employment <1 percent
Power Provide Rate Risk	Public-Owned Utility Investor-Owned Utility
Fixed Income Ratepayers	Poverty Rate >10 percent of all families Poverty Rate <10 percent of all families
New Power Plant Operation	Increase in Employment >1 percent Increase in Employment <1 percent
New Plant Construction	Increase in Regional Employment >5% Increase in Regional Employment <5% Within 50 miles of Potential Plant Siting
Non-fishing River Recreation	Increase in Employment >1 percent Increase in Employment <1 percent Short-Term Displacement Short-Term Crowding
Anadromous Fishing Recreation	Increase in Employment >1 percent Increase in Employment <1 percent Short-Term Displacement Short-Term Crowing Local Fishing Opportunities

Site Access	Decrease in Site Access >25 percent Decrease in Site Access <25 percent
Site Services	Decrease in Site Services >25 percent Decrease in Site Services <25 percent
Elderly Recreationists	Over 65 years >20 percent Over 65 years <20 percent
Social Cohesion	Increased Social Cohesion Decreased Social Cohesion
Recovery Uncertainty/Risk	Lower Uncertainty of Salmon Recovery Higher Uncertainty of Salmon Recovery
Business Uncertainty/Risk	Lower Economic Uncertainty/Risk Higher Economic Uncertainty/Risk
Extinction Risk/Existence Value	Higher Extinction Risk Lower Extinction Risk
Population Impacts	Decrease in Population >5% Decrease in Population <5% Increase in Population >5% Increase in Population <5%
Total Long-Term Employment	Employment Losses >5 percent Employment Losses <5 percent Increase Net Employment >1% Increase Net Employment <1% Decrease Net Employment >1% Decrease Net Employment <1%
Total Short-Term Employment	Increase in Employment >5 percent Increase in Employment <5 percent
Total Subregional Employment	Increase Net Employment >1% Increase Net Employment <1% Decrease Net Employment >1% Decrease Net Employment <1%
Aesthetics	ST: Exposed Shoreline LT: Revegetated Shoreline

Table 13.3. Elements of the Leopold Environmental Matrix:
Described in Terms of Characteristics, Conditions, and Factors as well as Proposed Actions

I. EXISTING CHARACTERISTICS, CONDITIONS, AND FACTORS OF THE ENVIRONMENT

A. PHYSICAL AND CHEMICAL CHARACTERISTICS

1. Earth
a. Mineral resources
b. Construction material
c. Soils
d. Land form
e. Force fields and background radiation
f. Unique physical features

2. Water
a. Surface
b. Ocean
c. Underground
d. Quality
e. Temperature
f. Recharge
g. Snow, ice and permafrost

3. Atmosphere
a. Quality (gases, particulates)
b. Climate (micro, macro)
c. Temperature

4. Processes
a. Floods
b. Erosion
c. Deposition (sedimentation, precipitation)
d. Solution
e. Sorption (ion exchange, complexing)
f. Compaction and settling
g. Stability (slides, slumps)
h. Stress-strain (earthquake)
i. Air Movements

B. BIOLOGICAL CONDITIONS

1. Flora
a. Trees
b. Shrubs
c. Grass
d. Crops
e. Microflora
f. Aquatic plants
g. Endangered species
h. Barriers
i. Corridors

2. Fauna
a. Birds
b. Land animals including reptiles
c. Fish and Shellfish
d. Benthic organisms
e. Insects
f. Microfauna
g. Endangered species
h. Barriers
i. Corridors

C. CULTURAL FACTORS

1. Land Use
a. Wilderness and open spaces
b. Wetlands
c. Forestry
d. Grazing
e. Agriculture
f. Residential
g. Commercial
h. Industrial
i. Mining and quarrying

2. Recreation
a. Hunting
b. Fishing
c. Boating
d. Swimming
e. Camping and Hiking
f. Picnicking
g. Resorts

3. Aesthetic and Human Interest
a. Scenic views and vistas
b. Wilderness qualities
c. Open space qualities
d. Landscape design
e. Unique physical features
f. Parks and reserves
g. Monuments
h. Rare and unique species or ecosystems
i. Historical or archeological sites and objects
j. Presence of misfits

4. Cultural Status
a. Cultural patterns (life style)

b. Health and safety
c. Employment
d. Population density

d. Waste disposal
e. Barriers
f. Corridors

5. Man-made Facilities and Activities
a. Structures
b. Transportation network (movement, access)
c. Utility networks

D. ECOLOGICAL RELATIONSHIPS SUCH AS:
a. Salinization of water resources
b. Eutrophication
c. Disease-insect vectors
d. Food Chains
e. Salinization of surficial material
f. Brush encroachment
g. Other

OTHERS
a.
b.

II. PROPOSED ACTIONS WHICH MAY CAUSE ENVIRONMENTAL IMPACT

A. MODIFICATION OF REGIME
a. Exotic flora and fauna introduction
b. Biological controls
c. Modification of habitat
d. Alteration of ground cover
e. Alteration of ground water hydrology
f. Alteration of drainage
g. River control and flow modification
h. Canalization
i. Irrigation
j. Weather modification
k. Burning
l. Surface or paving
m. Noise and vibration

B. LAND TRANSFORMATION AND CONSTRUCTION
a. Urbanization
b. Industrial sites and buildings
c. Airports
d. Highways and bridges
e. Roads and trails
f. Railroads
g. Cables and lifts
h. Transmission lines, pipelines and corridors
i. Barriers including fencing
j. Channel dredging and straightening
k. Channel revetments
l. Canals
m. Dams and impoundments
n. Piers, seawalls, marinas, and sea terminals
o. Offshore structures
p. Recreational structures
q. Blasting and drilling
r. Cut and fill
s. Tunnels and underground structures

C. RESOURCE EXTRACTION
a. Blasting and drilling
b. Surface excavation
c. Subsurface excavation and retorting
d. Well drilling and fluid removal
e. Dredging
f. Clear cutting and other lumbering
g. Commercial fishing and hunting

D. PROCESSING
a. Farming
b. Ranching and grazing
c. Feed lots
d. Dairying
e. Energy generation
f. Mineral processing
g. Metallurgical industry
h. Chemical industry
i. Textile industry
j. Automobile and aircraft
k. Oil refining
l. Food
m. Lumbering
n. Pulp and paper
o. Product storage

E. LAND ALTERATION
a. Erosion control and terracing

b. Mine sealing and waste control
c. Strip mining rehabilitation
d. Landscaping
e. Harbor dredging
f. Marsh fill and drainage

F. RESOURCE RENEWAL
a. Reforestation
b. Wildlife stocking and management

G. CHANGES IN TRAFFIC
a. Railway
b. Automobile
c. Trucking
d. Shipping
e. Aircraft
f. River and canal traffic
g. Pleasure boating
h. Trails
i. Cables and lifts
j. Communication
k. Pipeline

H. WASTE EMPLACEMENT AND TREATMENT
a. Ocean dumping
b. Landfill
c. Emplacement of tailings, spoil and overburden
d. Undergoing storage
e. Junk disposal
f. Oil well flooding
g. Deep well emplacement
h. Cooling water discharge
i. Municipal waste discharge including spray irrigation
j. Liquid effluent discharge
k. Stabilization and oxidation ponds
l. Septic tanks, commercial and domestic
m. Stack and exhaust emission
n. Spent lubricants
c. Ground water recharge
d. Fertilization application
e. Waste recycling

I. CHEMICAL TREATMENT
a. Fertilization
b. Chemical deicing of highways, etc.
c. Chemical stabilization of soil
d. Weed control
e. Insect control

J. ACCIDENTS
a. Explosions
b. Spills and leaks
c. Operational failure

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