Green group:

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Boulder CO

Assignment

- Scientific Challenges/Questions regarding deltas with strong human imprints
  How do Deltas work?
  - Physical
  - Ecological
  - Social

  } Holistic/Integrated Approach
- Question of vulnerability of biological or human populations on Deltas.

What are Deltas important for?

- Deltas and Estuaries are important for:
  - Trade, thus city development
  - Fisheries
  - Recreation
  - Energy Resources
- Deltas are specifically favorable for:
  - Agriculture – soil and water, gradient
  - Store carbon

Scientific challenges

- We do not know how to define the background normal state of a delta
- Deltas today are anthropogenic, need to separate natural signal from human signal to get base point or reference point.
- Holocene time most important period to look at?
- What is time span to consider? Days? Years, Ky, My? Need to manage for a variety of time scales

Do we know how Deltas work?

- Physical processes can be modeled and are broadly predictive. Rules of thumb exist for natural system.
- We know the big picture, but not the details (i.e. catastrophic events)
- Do we know how deltas function without human interference? We can describe mathematically – but plants and other species and structures change the ground rules.
- When systems become so out of equilibrium (Rhine, Miss) we can't back out the anthropological effects because of the very large number of variables.
- Totally engineered system is easy to model, natural system can be modeled, the in between is where we have difficulty modeling?
- Ecologically, systems can be characterized.
- Social sciences – human behaviors on Deltas are not predictable
- How do we incorporate the social knowledge (population, GDP, etc) into the physical models? Use of combined variable indices?

Cultural differences : Natural dynamics

- Humans like boundaries, and they like them to be static so we cement them in place – Deltas and coastlines are the most dynamic boundaries that exist, so we need to learn to live with them.
- Unnatural boundaries are made by humans – don’t see boundaries from space.
- Humans oppose the dynamism of the natural system to try to create static situation, but natural processes are still occurring.
- Cultural difference in western compared to Eastern ways of looking at nature. Asians look at dynamic systems and how to realign with them. Time frame 1000s years vs next year.

Predictability/Flexibility

- Impacts of human land use (i.e. water extraction) on delta cause physical effects that humans then must deal with.
- Birds move to favorable site vs humans with infrastructure with less flexibility hence more predictability.
- Should deltas be partitioned so that more vulnerable areas are left natural and human infrastructure is kept in more stable site?

What do we know

- Delta includes the watershed that feeds it
- Inputs to deltas may be impacted even if delta itself is pristine.
- There is no generic delta from physical processes or watershed standpoint, variety of countries/cultures is also not generic. (Customized approach seems warranted – don't generalize.)
- Suggestion: Define challenges for each of a selected group of deltas to look for trends.
- Suggestion: Database with variety of descriptors from Physical, Biological, Social sciences. Key parameters that define each delta.
- Many deltas have been partitioned for variety of land uses

What do we not know

- What ecological communities were present? How would we know if they disappeared?
- How do we make more flexible static human systems? How to adjust to make engineering thinking more flexible and holistic – externalities.
- What is a successful example of human – delta interaction that could be emulated.
- What is our goal for delta management? How would we define success?
  - Land loss is key issue.
  - 2 types - lack of sediment supply/progradation as well as subsidence
  - Land loss in one location and accretion in another – geopolitical issues. Water rights and usage is another issue?

Thresholds for catastrophic events?

- Big picture vs details

Questions

- How many deltas are there that are of some significance?
- How do we select “significant” deltas to study?
- More developed the country is, more out of equilibrium the delta is likely to be (Rhine or Miss vs Fly)
- How do we define equilibrium of a delta?
  - Dynamic equilibrium = system responds to forcing events (both physical and ecological)
- How to ameliorate human created situations to improve delta/ecosystem health?
- Ideally – How can we get to a point where humans maintain and allow ecosystem to rebound in the face of natural changes and population growth.
- How to change human behavior to do this? Qualitative

Vulnerability

- Look at Systems, Sectors (economic) and Groups (human)
- Adaptation and mitigation
- How to function?
- Integration on a system level?
- How do climate change processes affect the system – how to adjust or adapt
- Biggest and most unpredictable variable is Human