■ collapse of civilizations
  ■ population crash...
  ■ population dispersal...
  ■ population dislocation and urban abandonment...
  ■ state collapse...
  ■ cultural collapse...

■ the BIG theoretical issues
  ■ levels of organization...
  ■ is system collapse common?
  ■ internal vs. external
  ■ social vs. ecological
  ■ proximate vs. ultimate causes
    ■ proximate = how...
    ■ ultimate = why...
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■ Classic Maya collapse
  ■ evidence from Copán
  ■ drop in agricultural yield...
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    ■ increased aridity AD 800-1000
  ■ Moche IV-V transformation
    ■ evidence...
    ■ collapse of agricultural yield...
      ■ 30-60 year drought ca. AD 600
  ■ proximate causes
    ■ drop in K, falling food production
  ■ ultimate causes
    ■ populations grow exponentially
    ■ K is never stationary
    ■ social complexity is not a complete solution

■ defining the collapse of civilizations...
  ■ population crash = local/regional population size is dramatically reduced
  ■ urban abandonment = the permanent abandonment of one or more cities
  ■ population dispersal = formerly dense settlements reconfigure into many smaller settlements
  ■ population dislocation = population is “pushed” from one dense settlement to another
  ■ state collapse = disintegration of the economic, political and ideological power structures that characterize the state
  ■ cultural collapse...

■ cultural collapse = failure of the system that ensures the transmission of behavioral information

■ failure in transmission
  ■ population crash \(\rightarrow\) failure in learning environment
  ■ illiteracy \(\rightarrow\) failure in institutional memory

■ failure in innovation
  ■ causes not clearly understood
  ■ limited innovation \(\rightarrow\) narrow variability

Monoculture is a risky thing because it limits ability to adapt to changing environments...
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proximate causes
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levels of organization
- why do groups of potentially autonomous agents “decide” to organize together when they could function on their own?

- cells in a multi-cellular organism, families in a foraging band, commoners, craft specialists, and elites in a state
- sometimes groups derive a greater benefit from cooperating than they would by acting alone...
- but in many cases sub-units can do better by acting in their own interest...

is system collapse common?
- common where sub-units could do better on their own, if they can “break out” on their own.
- organismal cancer: certain cells decide to grow without regard for cost to other cells
  - a “relic” left over from the shift to multi-cellular life
- social cancer: sub-units within society act in their own best interest regardless of risk to future viability of society
  - short term gain, long-term loss?
- difficult for individual to predict which actions are terminally detrimental for society
  - time scale of effects critical!

internal vs. external mechanisms
- internal-external relatively easy to define in the case of disease or a gun-shot wound...
  - the boundary between the cells that make up the organism and the external environment is very sharp
- internal-external sometimes difficult to define for civilizations
  - city-states (relatively easy) - diffuse polities (very difficult)
- what is internal in a diffuse polity?
social vs. ecological mechanisms of collapse

- social mechanisms = pathologies (maladaptive behaviors) that originate within, or are the result of social organization
- ecological mechanisms = pathologies that originate in the environment, or from the interactions between people and the natural environment
- Drought...
- Diet based only on maize...

The boundary between social and ecological causes of collapse are also frequently “fuzzy” because (of course) society is part of one’s environment

Common Explanations for the Collapse of Civilizations

<table>
<thead>
<tr>
<th>SOCIAL</th>
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</tr>
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Qin Dynasty, 221-206 BC

A far less costly solution to display of political power (elite), and allegiance (citizens) that ensures the perpetuation of the state.

Tomb 1001 at Anyang, last capital city of Shang Dynasty
### Timescales

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#### Social vs. Ecological
- **Internal**
  - Political Struggle
- **External**
  - Warfare

#### Long Time Scales
- **State Collapse**
  - insufficient resources (labor, food) to support elites
  - rapid soil degradation

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#### Moche IV-V Transformation
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### Maya Collapse AD 750-909
- Copán geological evidence
  - houses filled with erosion debris beginning AD 750
- Copán skeletal evidence
  - skeletal remains indicate severe malnutrition; especially anemia
- Copán architectural evidence
  - last known hieroglyphic inscription at Copán AD 822
  - latest inscription known regionally is AD 909
- Copán botanical evidence
  - fully re-forested by AD 1250 as seen in Mahogany pollen
- Ethnoarchaeological evidence
  - current Maya farming practices are leading to rapid soil degradation

#### Events…
- drop in agricultural yield: soil degradation from over farming and increased aridity AD 800-1000
- population crash: 80% of people in Maya Lowlands died (?)
- urban abandonment: insufficient population to support urban centers
- dispersal: population dispersed into smaller settlements
- state collapse: insufficient resources (labor, food) to support elites
- time scale: multiple generations
Common Explanations for the Collapse of Civilizations

**SOCIAL**
- Political Struggle
- Farming Practices

**ECOLOGICAL**
- Drought
- Disease

**INTERNAL**
- Moche State AD 200-700
  - Moche valley
  - conquer valleys forming multi-valley system (600 km long)
  - Cerro Blanco (capital)
    - Huaca del Sol
      - 200 million bricks
      - elite residences on top
    - Huaca de la Luna
      - only 50 million bricks!!!
      - ritual function
      - bricks retain maker's stamp: corveé labor?

**EXTERNAL**
- Warfare
- Disease

---

Moche IV-V Transition AD 600

- geological evidence
  - ice cores from Andes indicate 30-60 years of severe drought just preceding Moche IV-V
  - sand dunes at Cerro Blanco choking irrigation canals
- archaeological evidence
  - Cerro Blanco abandoned and dense settlement begins at Pampa Grande

---

Moche IV-V Transition AD 600

- events...
  - crash in agricultural production: rapid onset of drought ca. AD 540-570 makes irrigation impossible
  - urban abandonment: insufficient population to support urban center
  - population dislocation: population moves to larger settlement in an inland valley farther North (where irrigation is still possible)
  - state collapse: insufficient resources (labor, food) to support political control along Peruvian coast
- time scale: single generation

---

map of the Moche State

huaca del sol, cerro blanco, moche valley, peru
proximate & ultimate causes

- proximate causes = how...
  - drop in K - falling food production
- ultimate causes = why...
  - populations grow exponentially
  - K is never stationary
  - social complexity is not a complete solution