Water

Energy

Life

Three basic criteria BEGIN a global suitability analysis to address the question: “If people locate themselves on the planet in harmony with its natural systems and biosphere, where should they be?” The EMPTY PLANET ANALYSIS...
WATER DYNAMICS of Sea, Land and Air;
ENERGY SYSTEMS of sustainable types;
BIO-DIVERSITY and the Web of Life

During historical times it remained more or less stable as ice melting was balanced by glacier building on land.

Now it is on the rise again.

Ocean levels have been reasonably constant during historical times.

People have assumed that “what they know is what will be...”

Population prior to 10,000 BP:
1-10,000,000 people

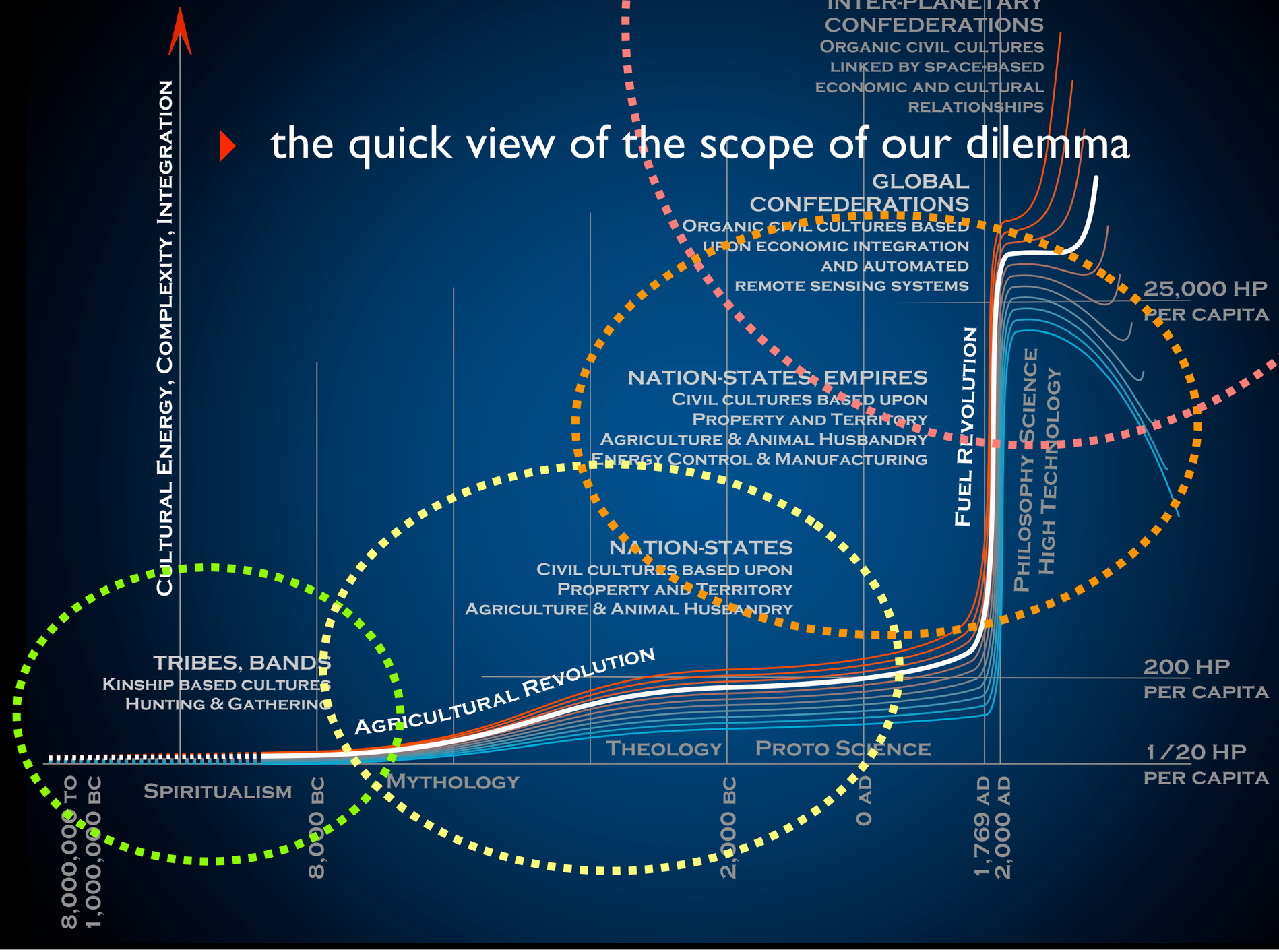
Rough average 10,000 BP to 1800 AD:
±500,000,000 people

Population 30 October 2008:
6,733,797,742 people

47.06 people / sq km (excludes Antarctica)
(increasing ±80,000,000 per year)

The People Part...

the quick view of the scope of our dilemma



The evolution of human cultures has been driven by technologies to control energy from the sun – or to exploit stored reserves...
Excessive exploitation has lead to excessive population –

“the Passenger Pigeon effect...”

- UN: IPCC states that the ocean will rise about half a meter in this century.
- Not counting mass transfer of ice into the sea, and other effects.
- Thus, actual rise may be anywhere from one half to 70 meters.
- "The bottom line: sea levels will rise much more than predicted by the IPCC, based on both present understanding of current glacial melt as well as evidence from the geologic record. 'The IPCC noted that their estimates should be seen as minimum estimates,' Carlson notes, 'and they are right.'"

  Warmer Antarctica Shows Climate Changing on Every Continent It's official: The South Pole is also succumbing to human-induced climate change, By David Biello, Scientific American, 31 October 2008

- An actual rise of 3-6 meters is rated as "likely" by a number of researchers.

It is probable that global warming cannot be reversed in time to prevent significant mass transfer of ice melt water into the ocean.

- Around half the people on the planet are at risk from rising seas, tsunamis and storm surges.

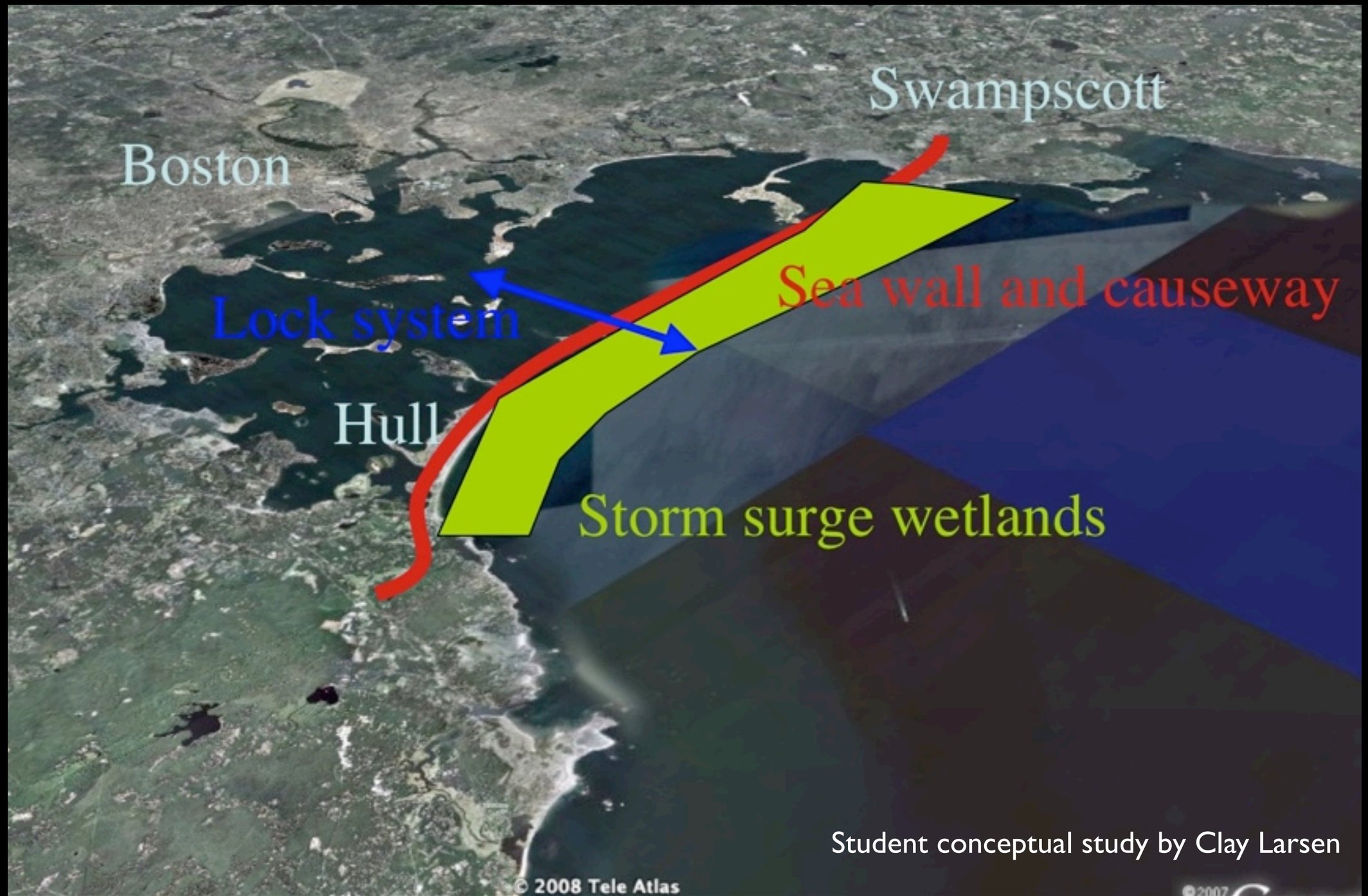
- In the coming decades over 3.5 billion may have to relocate or create serious adaptation measures comparable to those of the Netherlands.

- In the design community, we must face questions:
  “When should we adapt?”
  “When should we relocate?”
  “If people relocate, where should they go...?”

"As designers, your job over the next several decades will be to relocate 300 million people out of harm's way..."

George Poste, Director,
Biodesign Institute, during a lecture at Taliesin West.

Rising Seas, Storms, Floods, Pestilence, plus Bio-Terrorism...



Student conceptual study by Clay Larsen


NORDHAVNEN GREAT PARK
AT EXISTING LEVEL
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
PARKING
UNIVERSITY PARKING
CAR TUNNEL
NEIGHBORHOOD RAINWATER CISTERN (TYP.)
STORM SURGE GATES
TERRACES PROVIDE RELIEF FROM RISE IN WATER LEVEL

Principles of Suitability Analysis

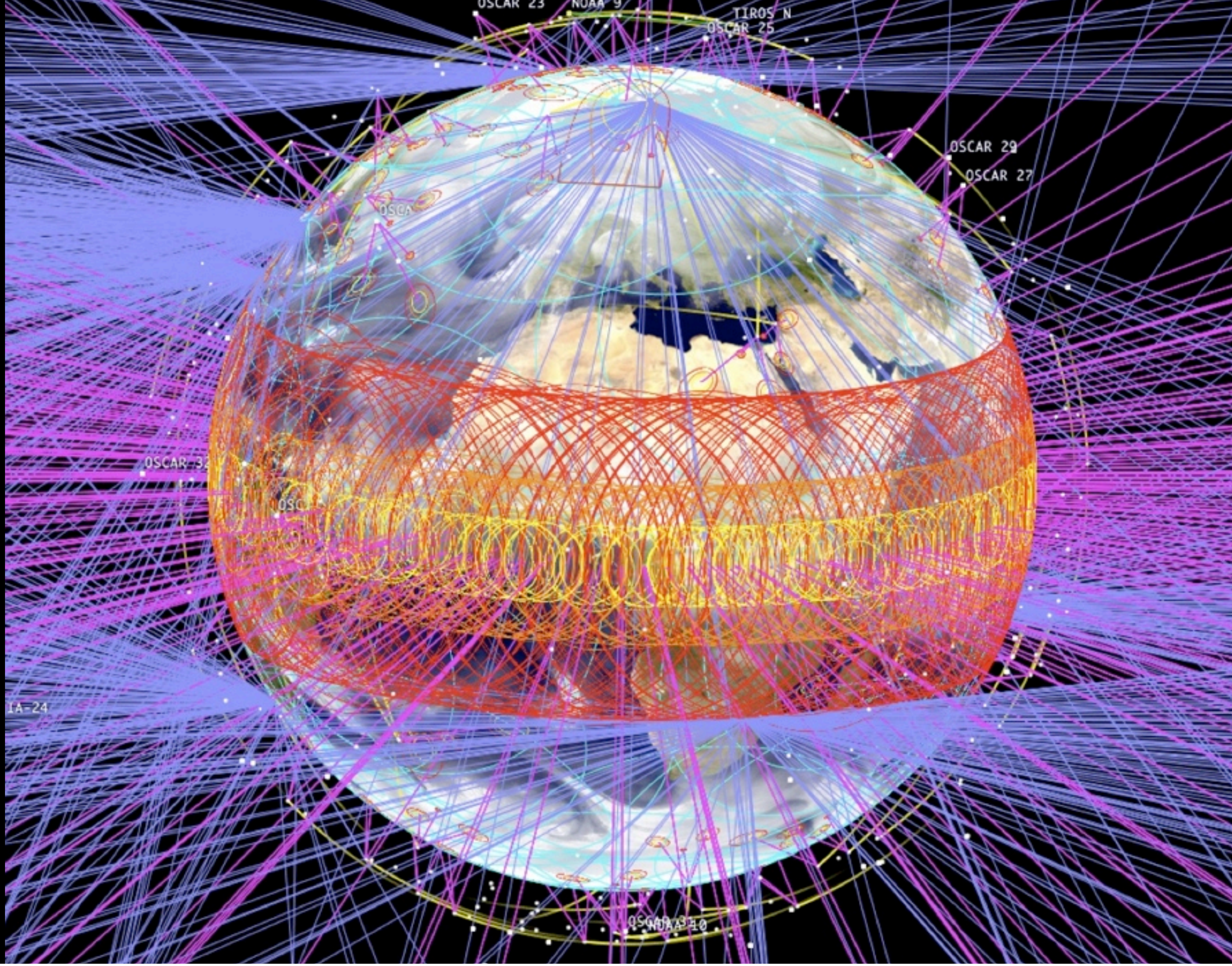
- A design-oriented process of searching the surface of the biospere for locations having a high probability of success in support of settlements.

- Primary criteria for success, such as renewable fresh water, adequate energy will dominate the mapping process.

- Data categories are mapped, frequently using GIS, and rated in importance to the search.

- Composite maps are created to reflect calculated results.

- The process must be iterative to reflect evolving realities.


OSCAR 23
NOAA 9
TIROS N
OSCAR 25
OSCAR 29
OSCAR 27
NOAA 10

FEEDBACK

PURPOSES
Ideological
Sociological
Attitudinal

MEANS
Subsistance
Defense
Reproduction

ANALYSIS & DESIGN

SETTLEMENT

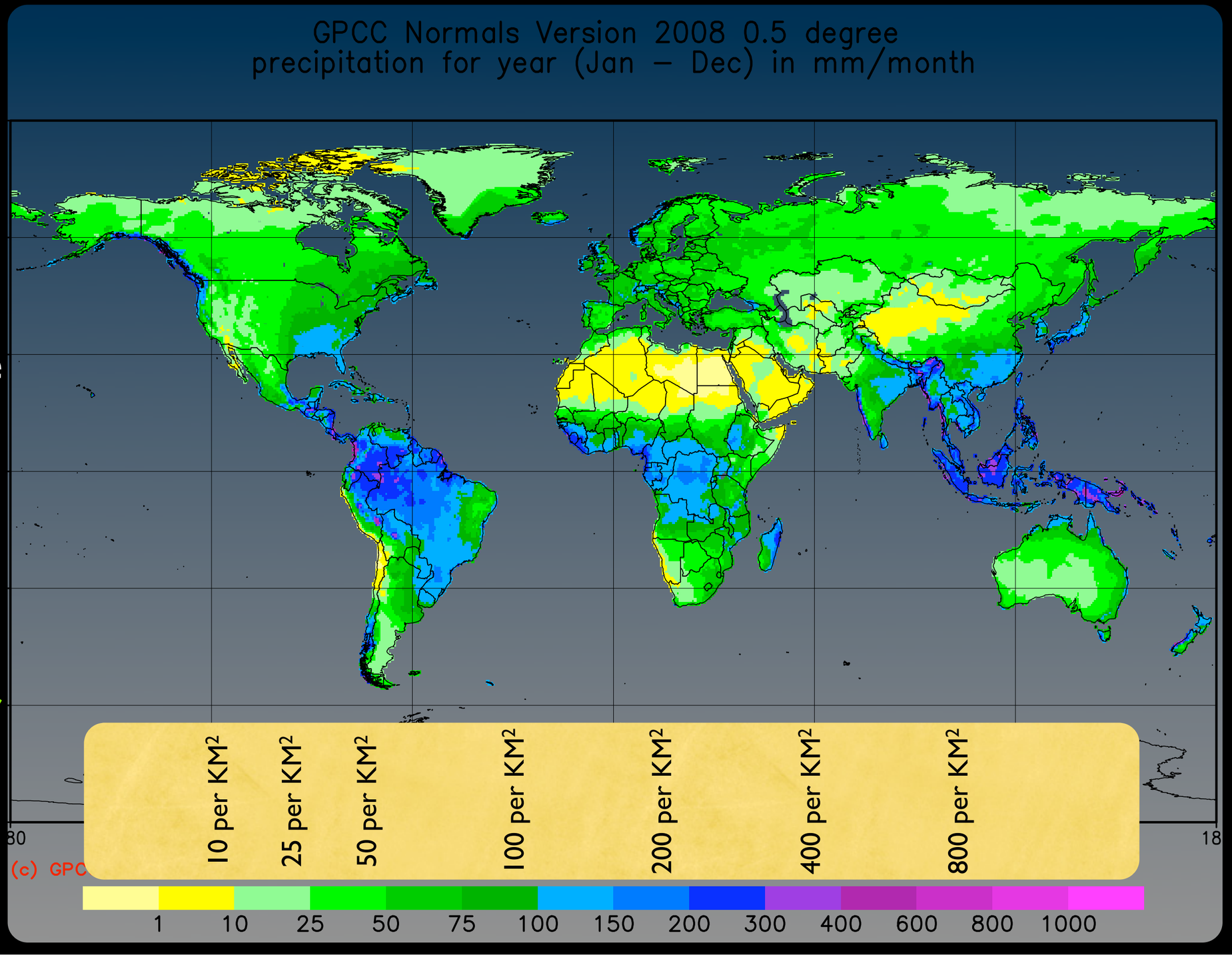
First Criteria: Fresh Water

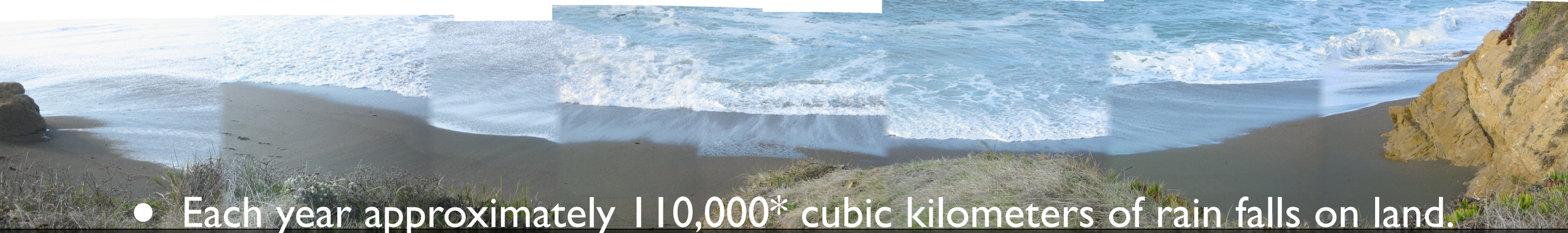
1938: 2,313,000,000 people could form 'Nine (9) Chains to the Moon,'
Buckminster Fuller

2008: 6,733,000,000 people can form 'Twenty Seven (27) Chains to the Moon,'

2038: ±9,800,000,000 people would form 'Thirty Eight (38) Chains?'

- ‘Normal’ Rainfall for 2008
- Greatest resource is close to the Equator
- Ideal human density relates to available renewable water (rain plus desalinate)

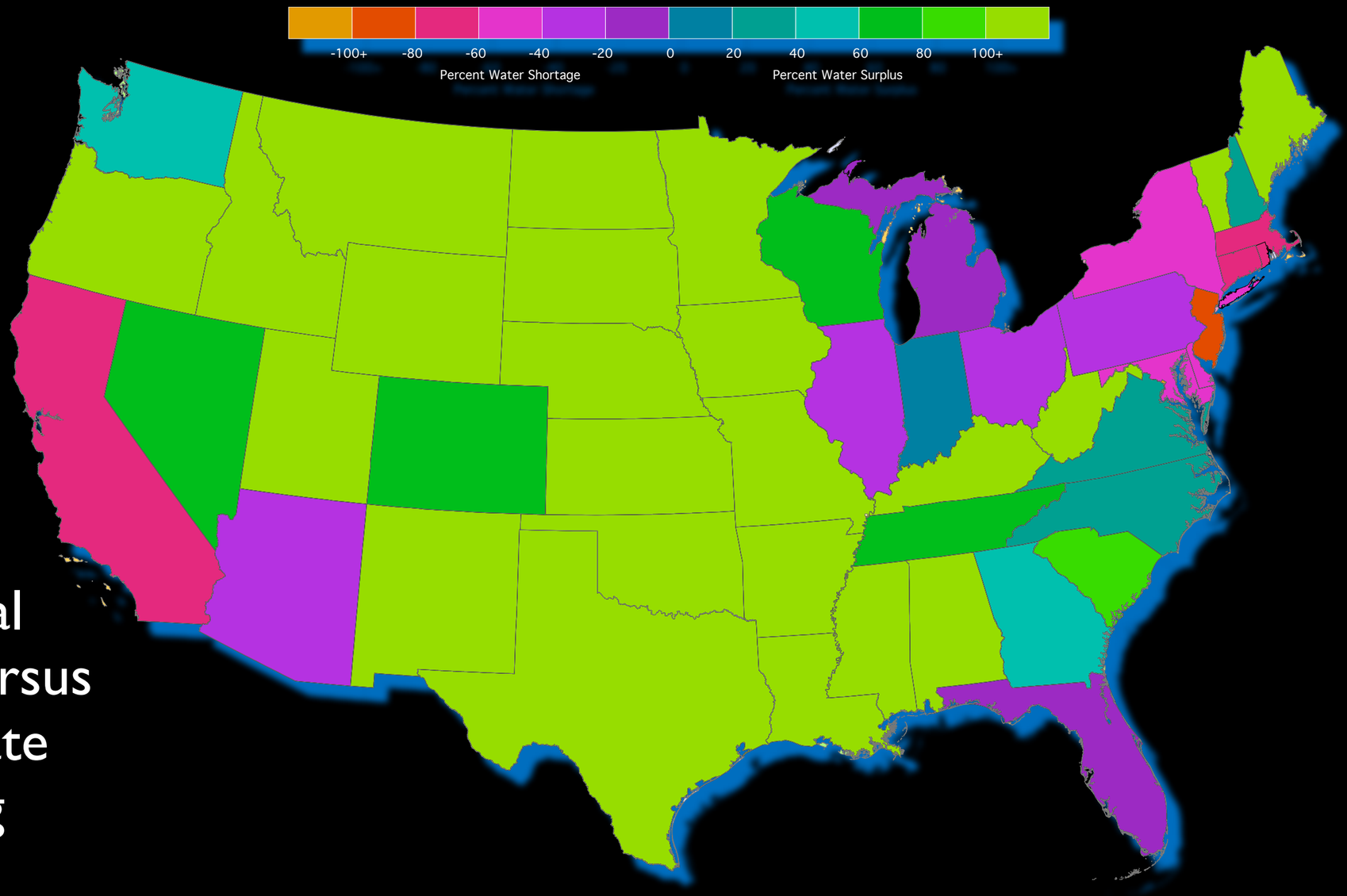




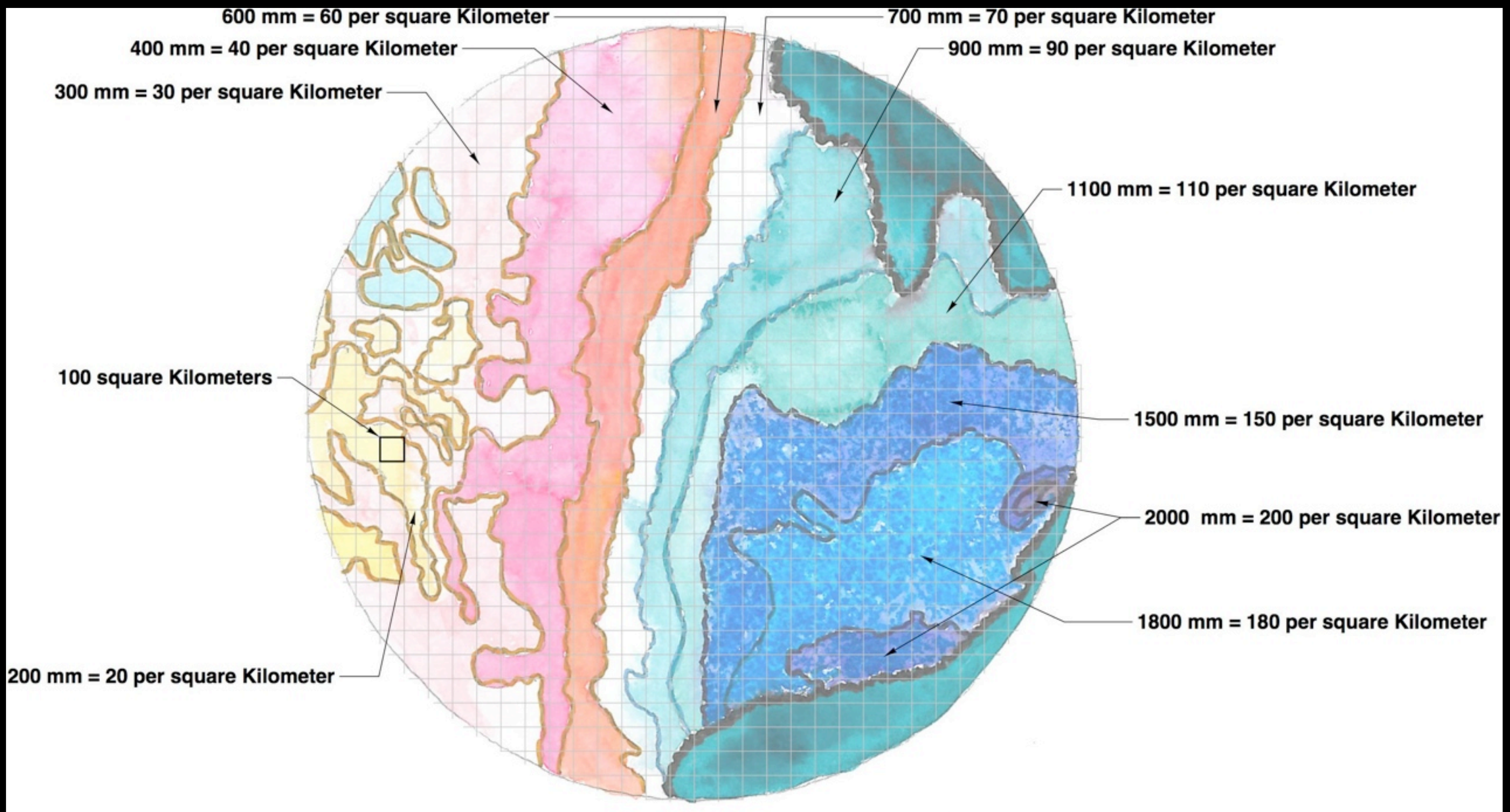
- Each year approximately 110,000* cubic kilometers of rain falls on land.

  * International Water Management Institute, Stockholm

- People presently use a total of about 5.6% of this amount, which equals about 6,160 cubic kilometers from all sources.
- Each person requires at least 1,000* cubic meters per year for drinking, hygiene and growing food.
- Thus 6,734,000,000 people require 6,734,000,000,000 cubic meters = about 6,734 cubic kilometers annually.
- The shortfall is about 575 cubic kilometers, which increases, at present, by about 8 cubic kilometers per year.
- This means that even if distribution was equitable (not!) 580-590,000,000 people would not have adequate water available.



- States with a global water shortage versus those with adequate rainfall for existing population



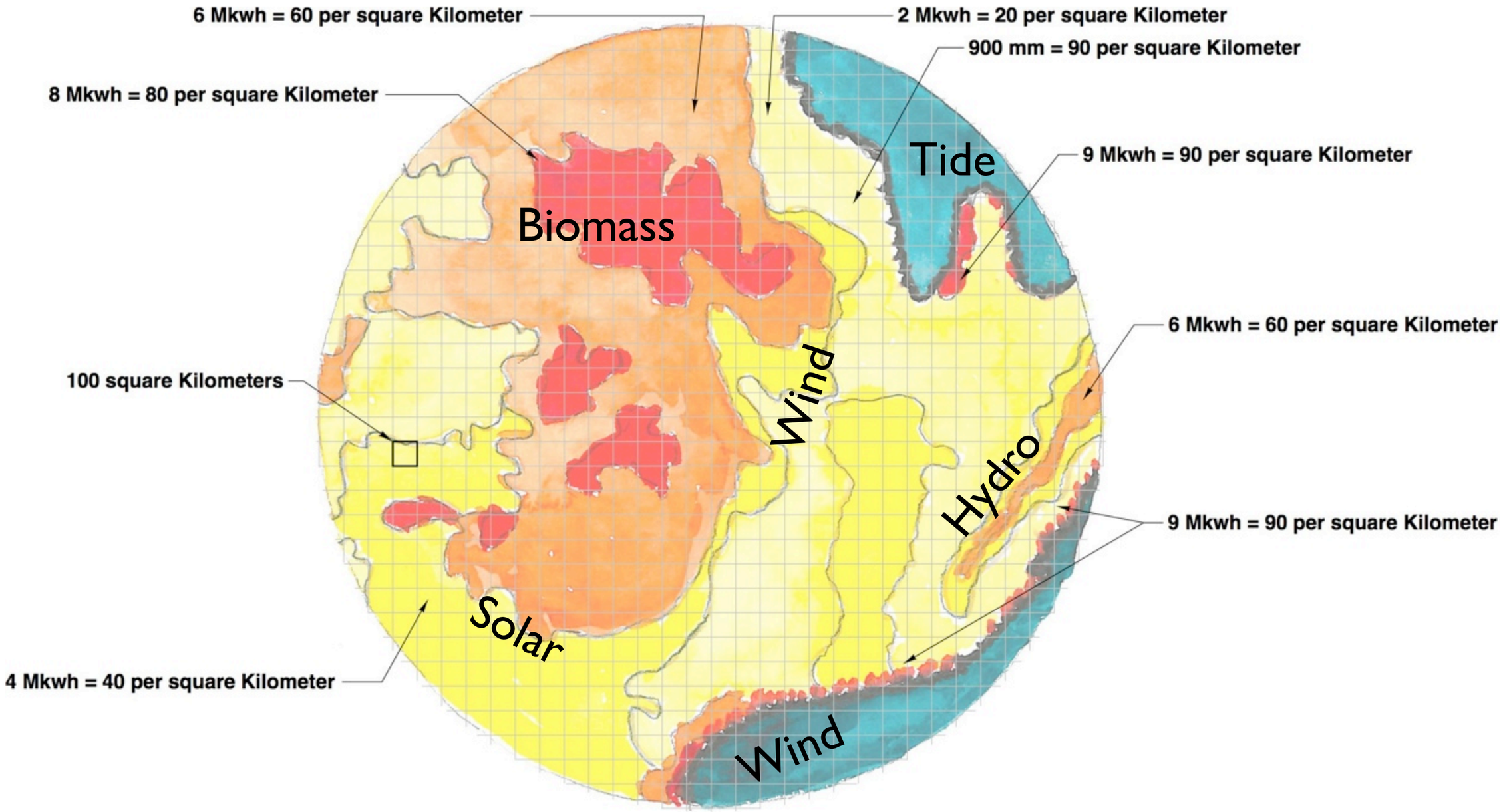
SETTLEMENT DENSITY LIMITED BY SUSTAINABLE WATER RESOURCES

(1000 cubic meters per Capita allowance (US presently uses 1600)

On this planet, all energy resouces derive from the Sun.

Second Criteria: Energy Resources

- The natural systems of the planet may restart without us.



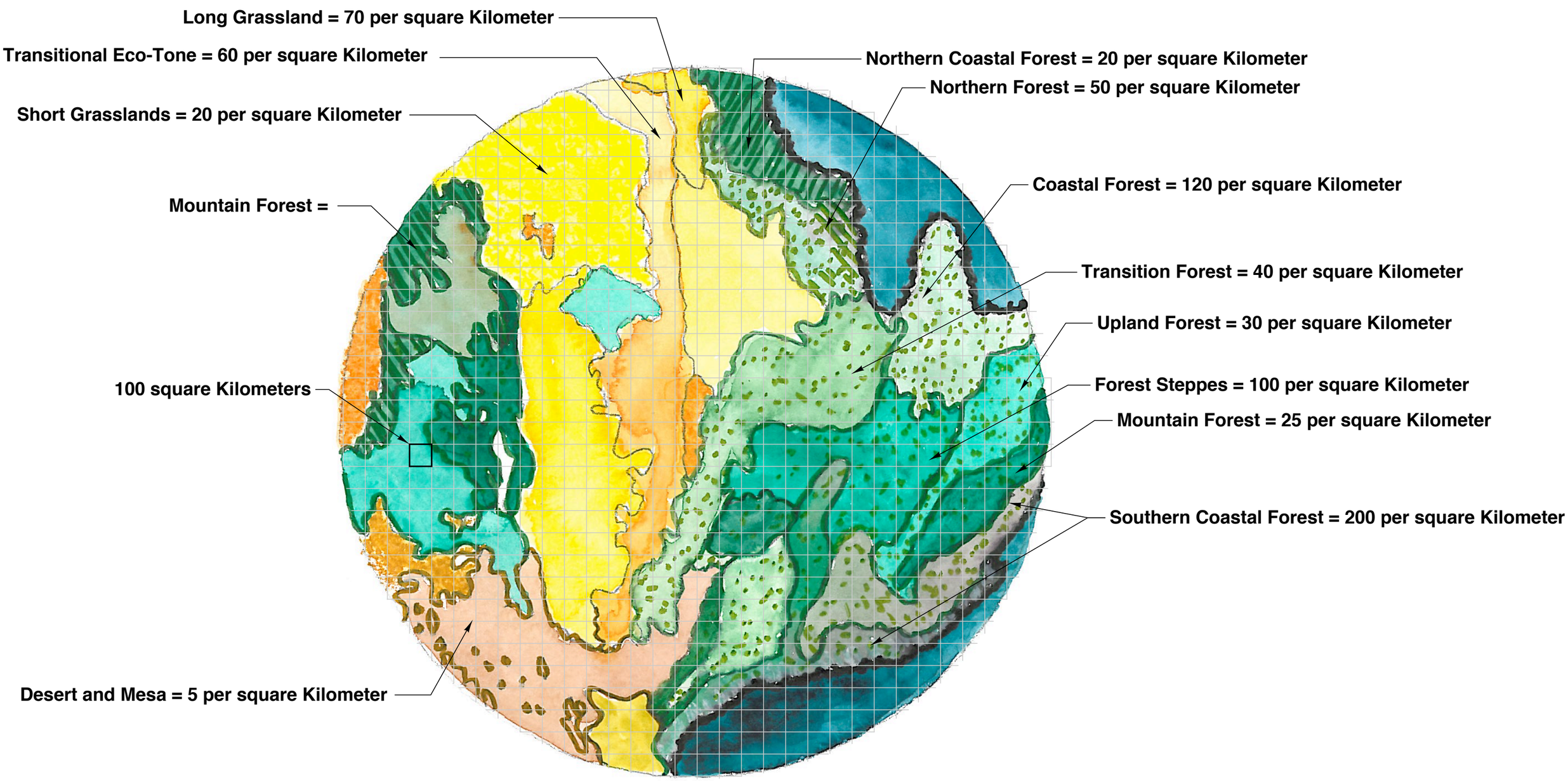
SETTLEMENT DENSITY LIMITED BY NET YIELD
of SUSTAINABLE ENERGY RESOURCES (5%)
(5000 kwh per Capita allowance)

Third Criteria: The Web of Life

"The central problem of the new century, I have argued, is how to raise the poor to a decent standard of living while preserving as much of the rest of life as possible...
I believe we will choose wisely. A civilization able to envision God and to embark on the colonization of space will surely find the way to save the integrity of this planet and the magnificent life it harbors."

The Future of Life
Edward O. Wilson

- Bioregions: "The key to reinhabiting the planet" - Thomas Berry



SETTLEMENT DENSITY LIMITED BY BIOREGIONAL MANAGEMENT GOALS
(assigned density assumptions)

Water
Energy
Life

- A hypothetical weighted composite
- To be refined with many additional data sets and purposes.

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Total Study Area = 72,000 sq km
Maximum Population = 3,202,000
Average Density (max) = 44.47 per sq km

Illustrative Settlements:

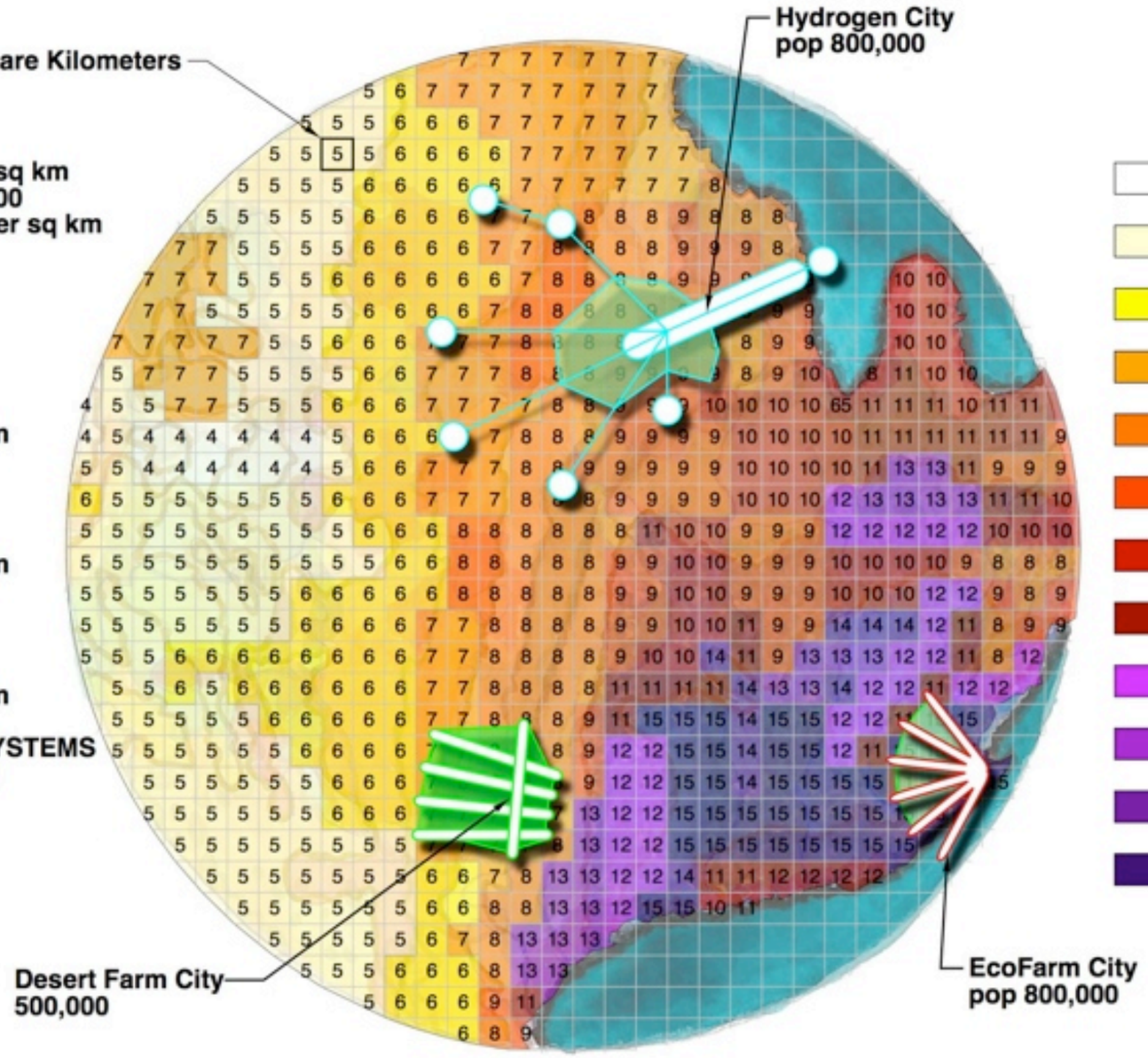
HYDROGEN CITY
design population = 800,000
settled area = 2,500 sq km
settlement density = 320 per sq km

DESERT FARM CITY
design population = 500,000
settled area = 2,100 sq km
settlement density = 238 per sq km

ECOFARM CITY
design population = 800,000
settled area = 1,150 sq km
settlement density = 695 per sq km

MANAGED AREA OF NATURAL SYSTEMS
all bioregions ± 52,000 sq km
% ± 70%

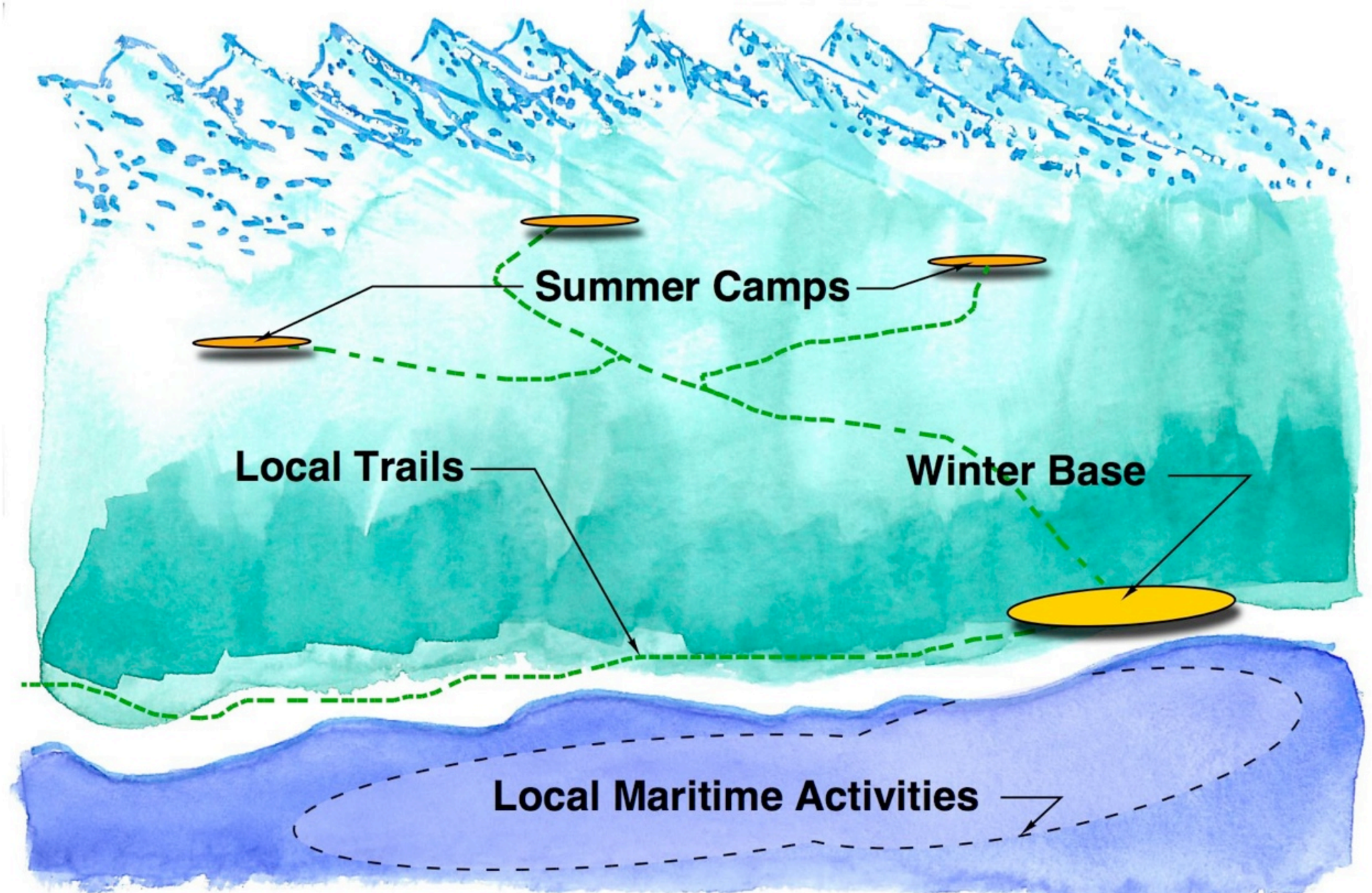
Future Growth Capability:
pop = 1,102,000
% = 34%



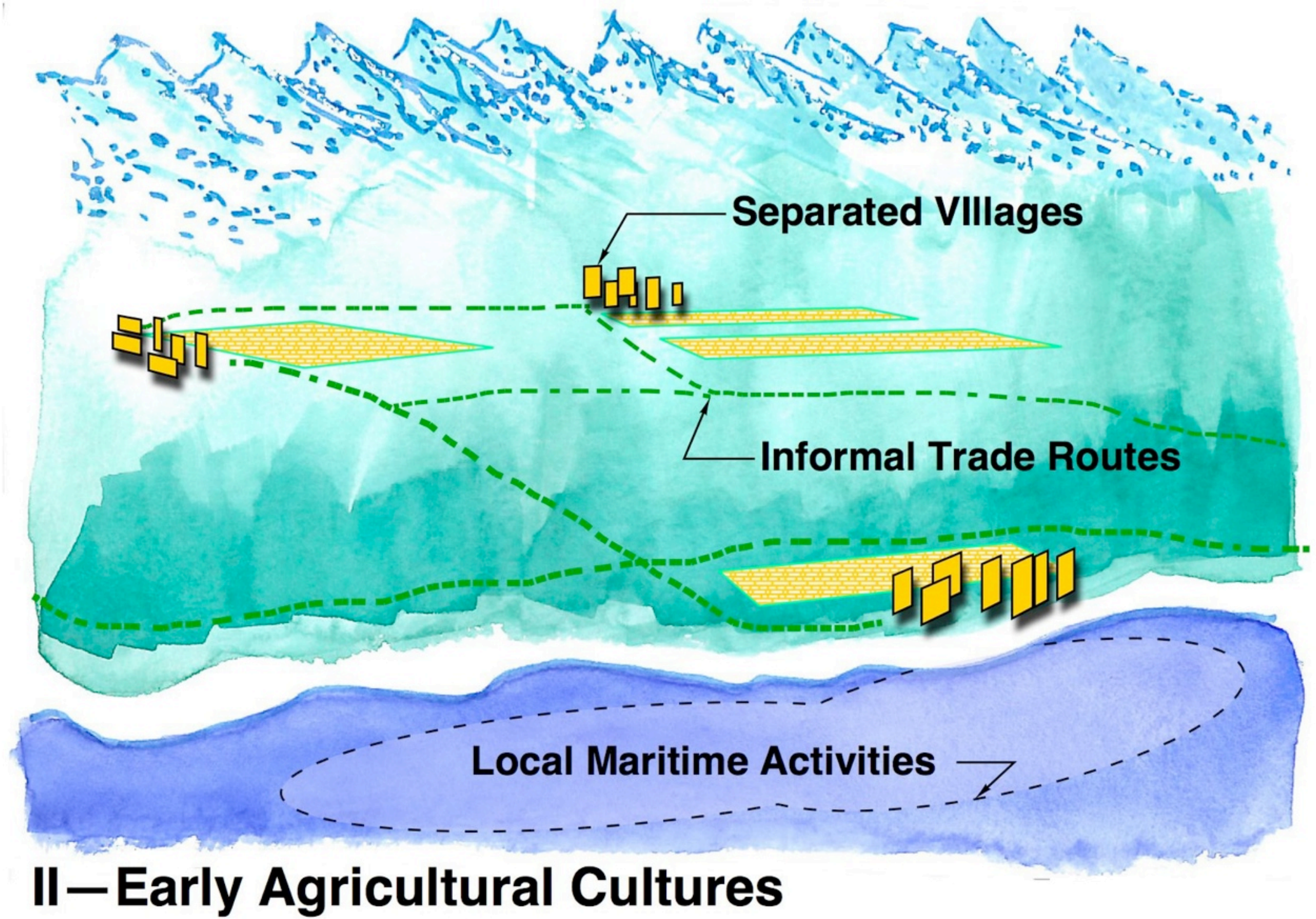
4 – up to 24 per sq km	x 1,300 Sq km = 31,000
5 – 36 per sq km	x 14,600 Sq km = 526,000
6 – 48 per sq km	x 10,500 Sq km = 504,000
7 – 60 per sq km	x 9,800 Sq km = 588,000
8 – 72 per sq km	x 9,200 Sq km = 662,400
9 – 84 per sq km	x 6,800 Sq km = 571,000
10 – 96 per sq km	x 4,800 sq km = 461,000
11 – 108 per sq km	x 3,600 sq km = 389,000
12 – 120 per sq km	x 3,000 sq km = 30,000
13 – 132 per sq km	x 2,200 Sq km = 290,000
14 – 144 per sq km	x 1,000 Sq km = 144,000
15 – 156 per sq km	x 4,200 sq km = 655,200

ANALYSIS FOR SETTLEMENT BY AVERAGE DENSITY

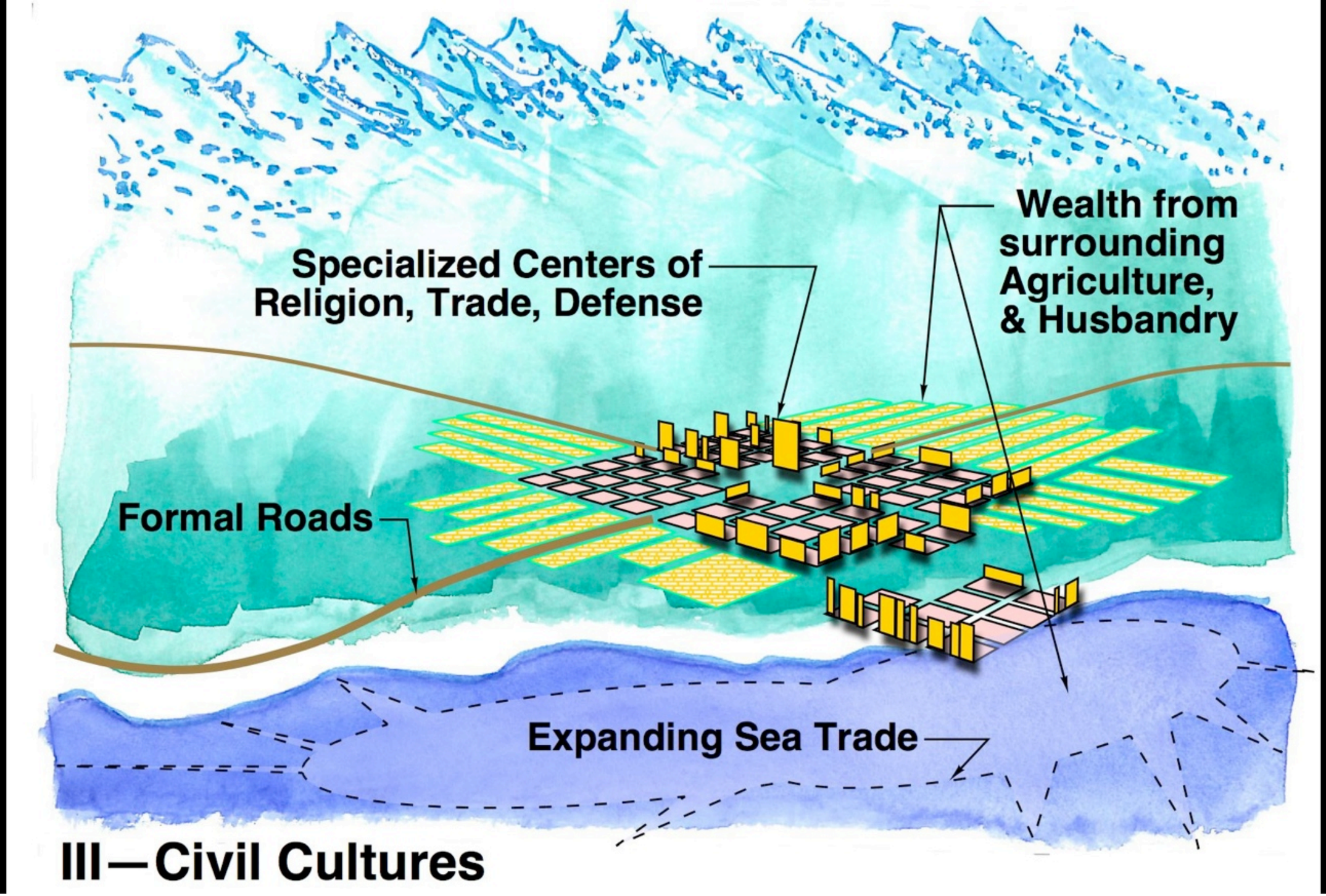
$$Sd = (2Wd + Ed + Bd) / 4$$



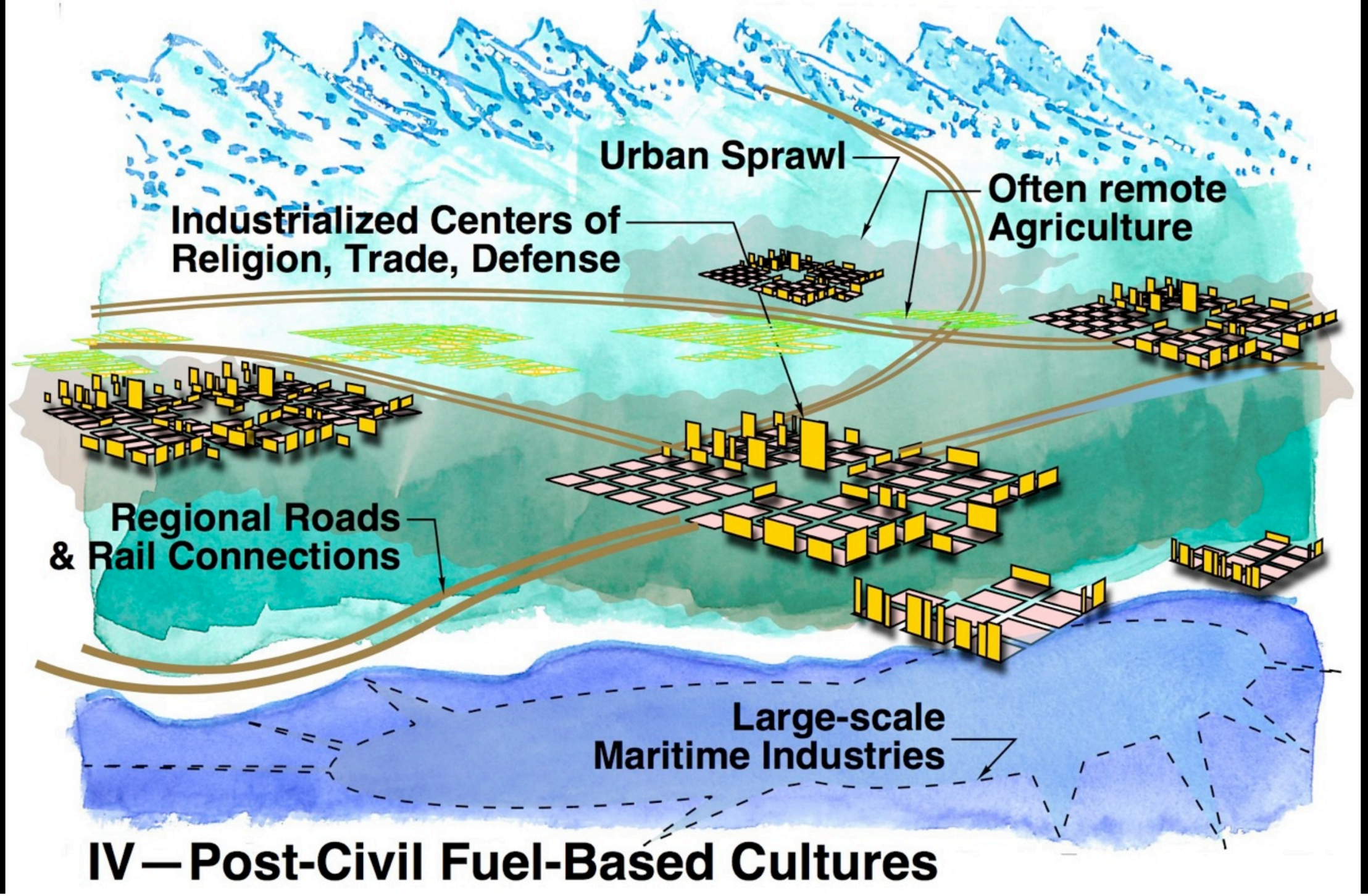
I—Hunting and Gathering Cultures



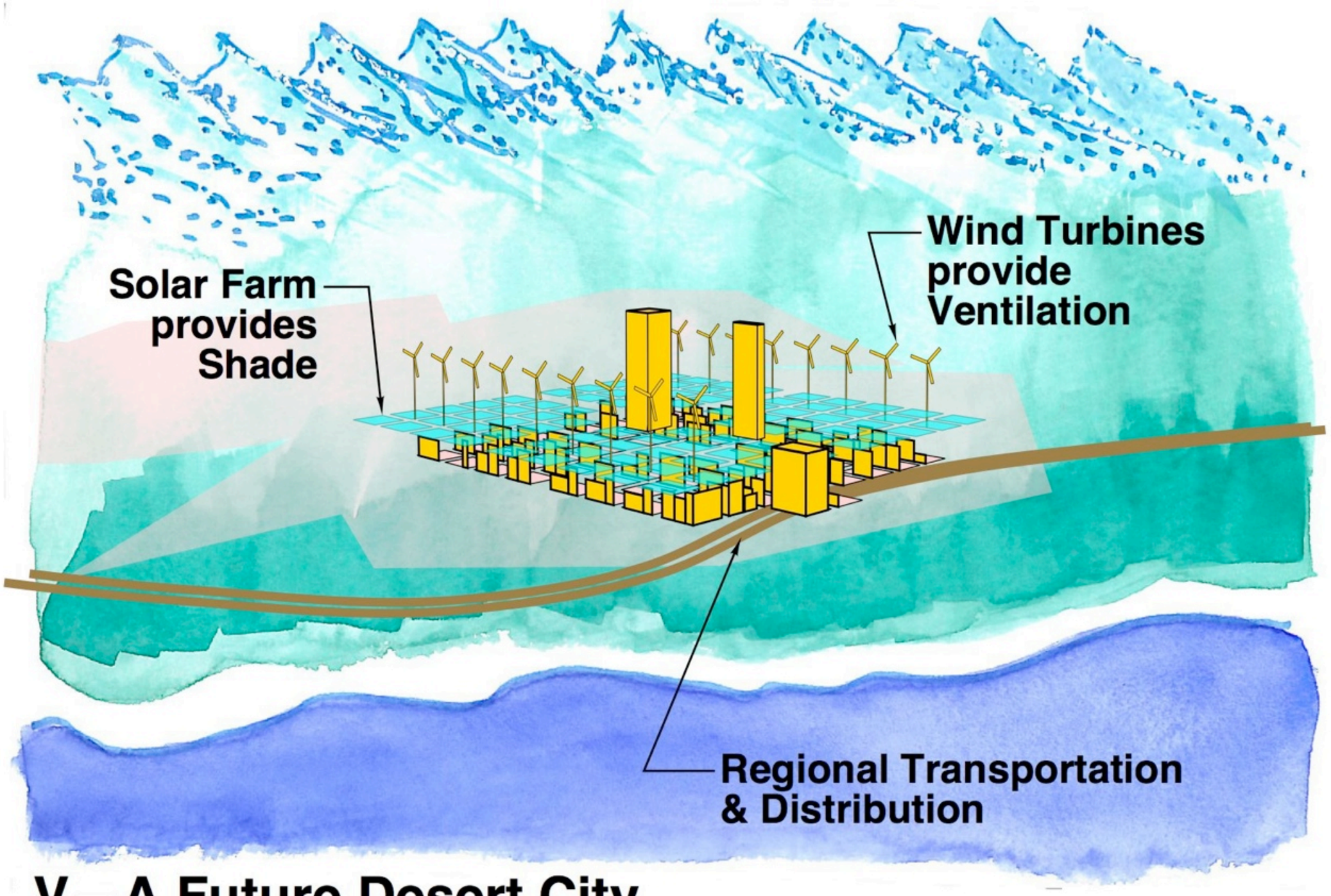
II—Early Agricultural Cultures



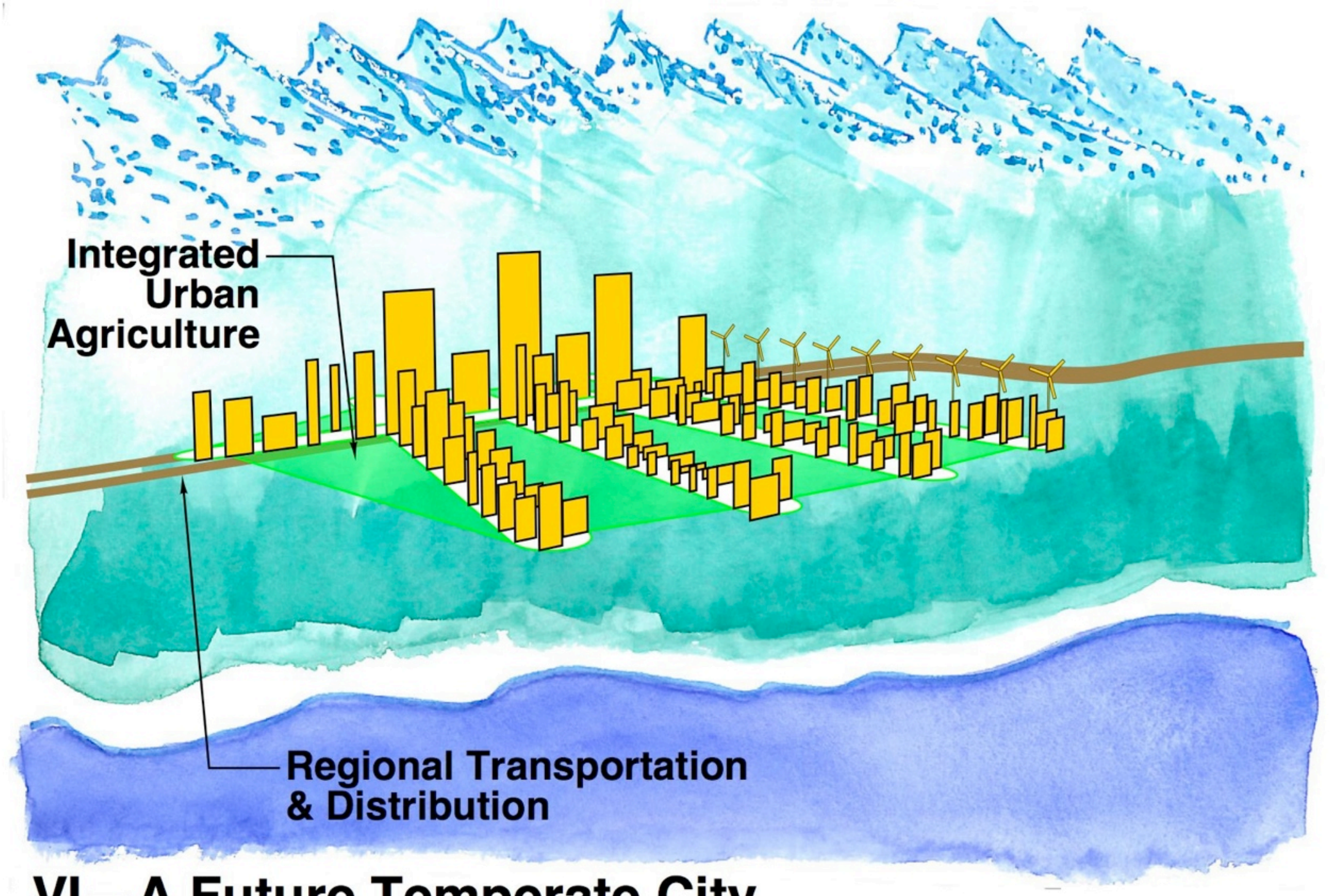
III—Civil Cultures



IV—Post-Civil Fuel-Based Cultures



V—A Future Desert City



VI—A Future Temperate City

- global design to fit people to the planet begins again...

- It is time to walk the walk, but it is a moving target...

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