How Sub-Saharan Africa can Achieve Food Security

and Ascend its Economy to the Initial Stages of Light Industrialization

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Sub-Saharan Africa

Present Situation in Sub-Saharan Africa

- In 2000, the world leaders committed to mobilize resources to free the world from abject and dehumanizing conditions of extreme poverty by establishing eight Millennium Development Goals (MDG)
- **The first MDG was to half extreme poverty that existed in 1990 by 2015**
- Extreme poverty is defined as people living on less than $1.25 per capita per day

	SSA	Rest of the World
1990	290 million	1.9 billion
2015	394 million	836 million

- Sub-Saharan Africa is the **only major region in the world that failed to meet 2015 MDG**
- In SSA, <u>extreme poverty has increased, not decreased</u>

Sub-Saharan Africa

Present Situation

- USAID's definition of extreme poverty
  - *The inability to meet basic consumption needs on a sustainable basis. People who tend to live in extreme poverty lack both income and assets and typically suffer from interrelated chronic deprivations, including hungry, malnutrition, poor health, limited education, and marginalization or exclusion*

Sub-Saharan Africa

Present Situation

- Malnutrition
  - Stunting
    - **Stunting in Zambia accounts for about 45-50% in rural areas and 35-40% in urban areas**
    - Irreversible outcome of inadequate nutrition
    - Diminished cognitive and physical development
    - Reduced adult economic productive capacity
    - Reduced intelligence and academic achievement
    - Increased mental impairment
    - Constraints ability to exercise full potential

Outline of Presentation

Achieving Food Security in SSA requires addressing the following major challenges:

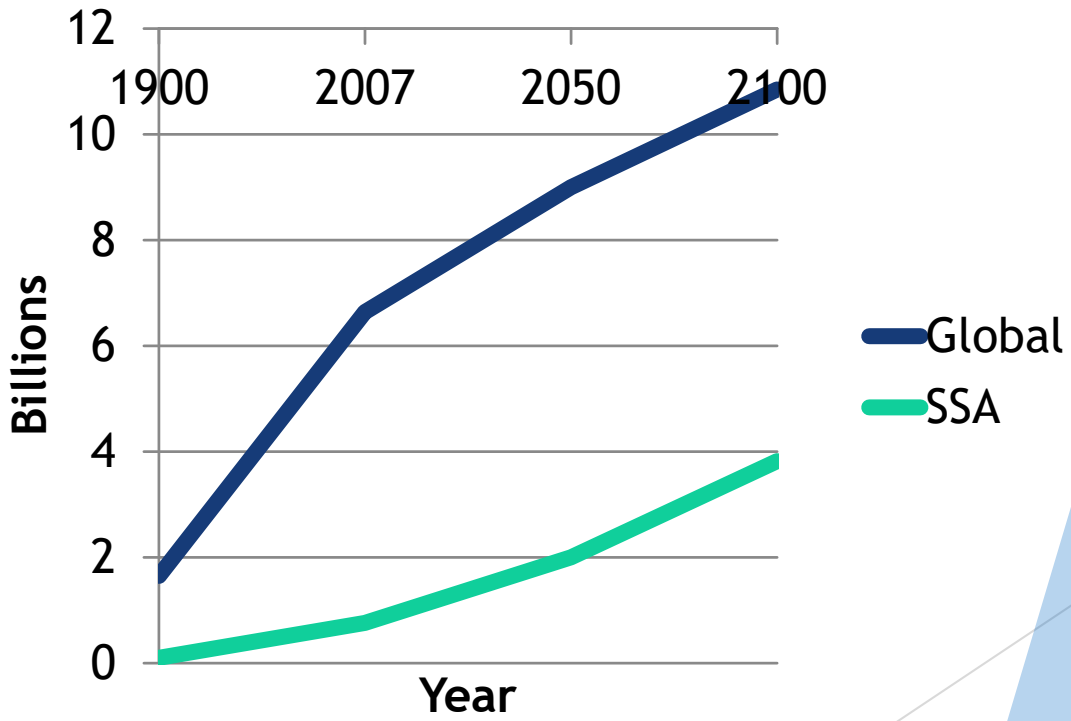
- **Reduce rapid population growth to lower demand for food**
  - Underlying problems, causes and solutions
- **Plan and manage degraded natural resources and environment**
  - Underlying problems, causes and solutions
- **Knowledge enhancement**
  - Underlying problems, causes and solutions
- **Increase agricultural productivity** by increasing cropped lands and crop yield per unit area
  - Underlying problems, causes and solutions
- ***Implementation of solutions to achieving food security and ascend SSA economic growth to be initial stages of light industrialization***

Underlying Problems

Rapid Population Growth

	1900	2007	2050	2100
Global	1.65 billion	6.64 billion	9 billion	10.85 billion
SSA	100 million	760 million	2 billion	3.82 billion
Percentage of SSA/Global	6.1%	11.4%	22.2%	35.2%

SSA & Global Population Growth

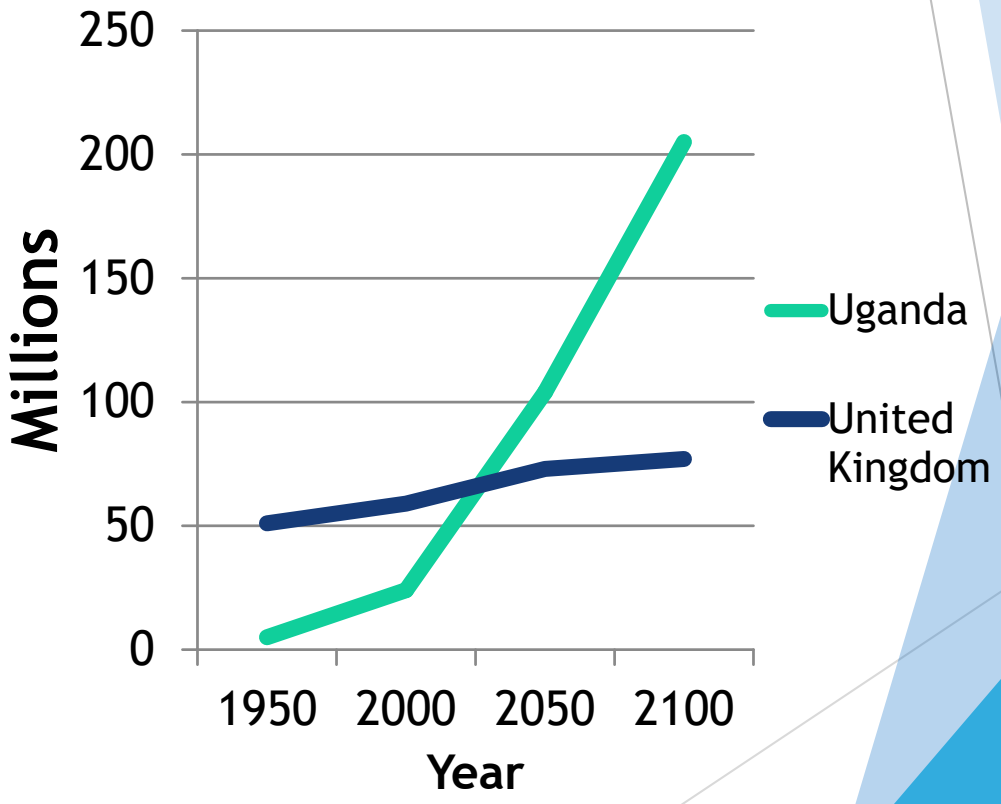


Underlying Problems

Rapid Population Growth

Uganda and United Kingdom Population Growth

	Land Mass in sq. km.	1950	2000	2050	2100
Uganda	242,000	5 million	24 million	104 million	205 million
United Kingdom	244,000	51 million	59 million	73 million	77 million
Percentage of SSA/Global		10%	41%	142%	266%



1950

Uganda

United Kingdom

2000

Uganda

United Kingdom

2050

Uganda

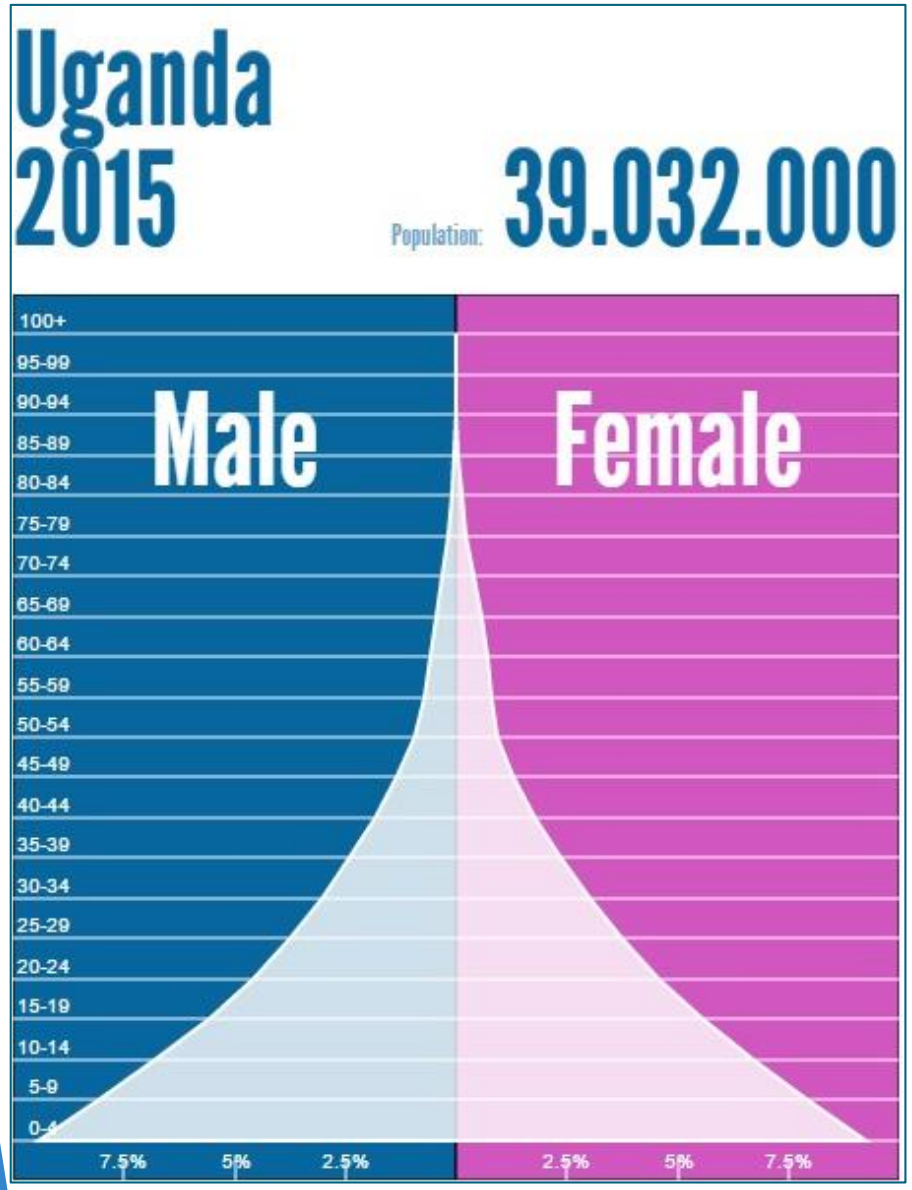
United Kingdom

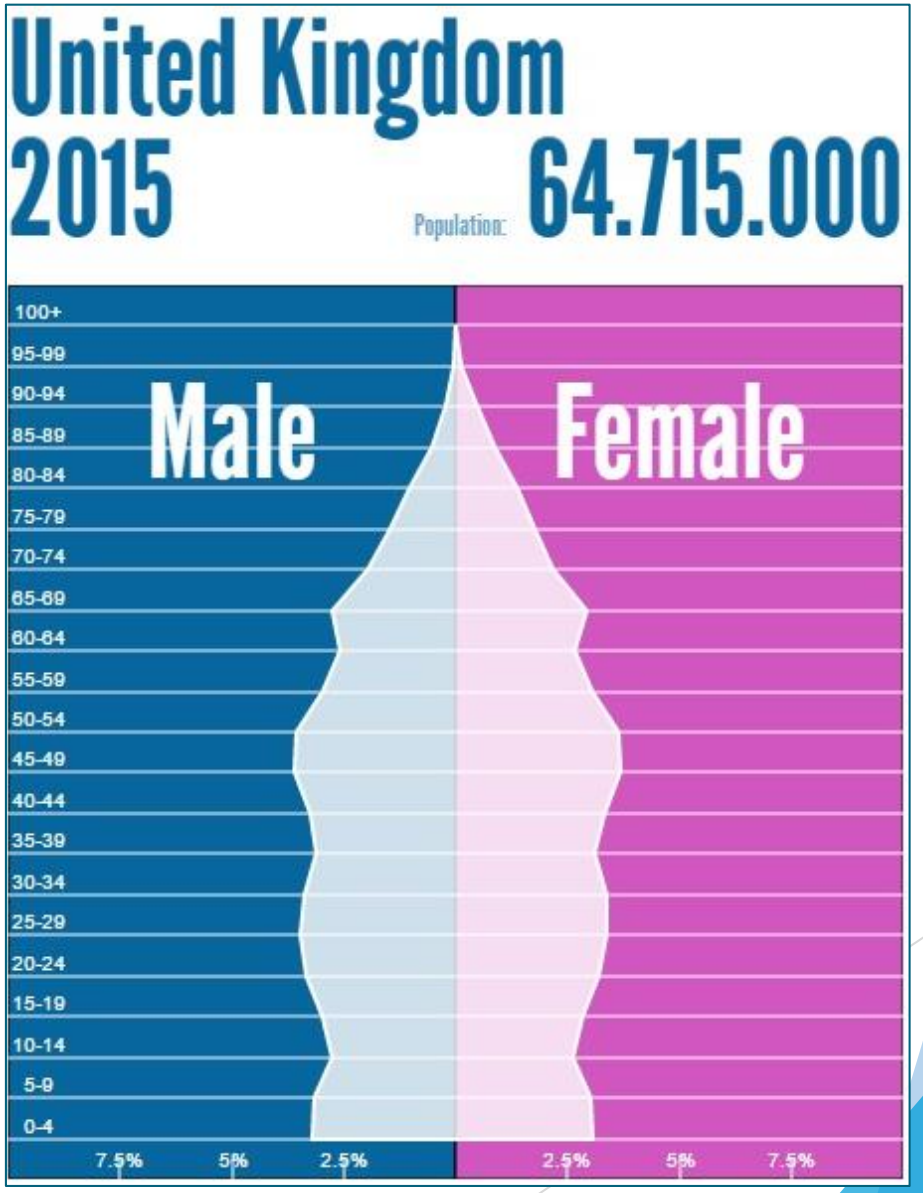
2100

Uganda

United Kingdom

Population Pyramids



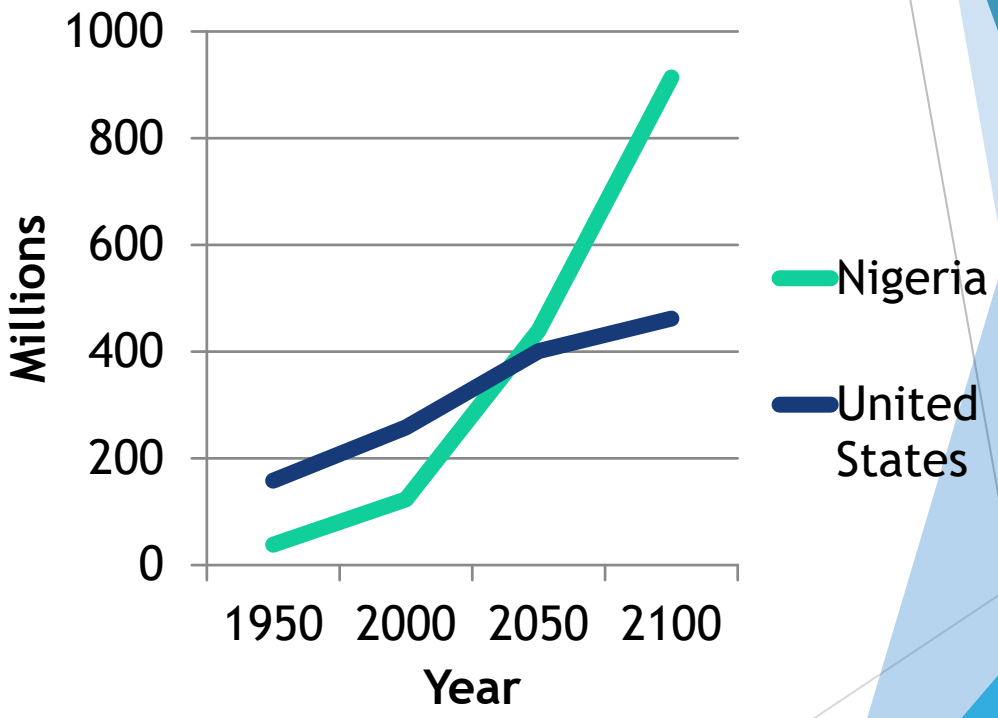


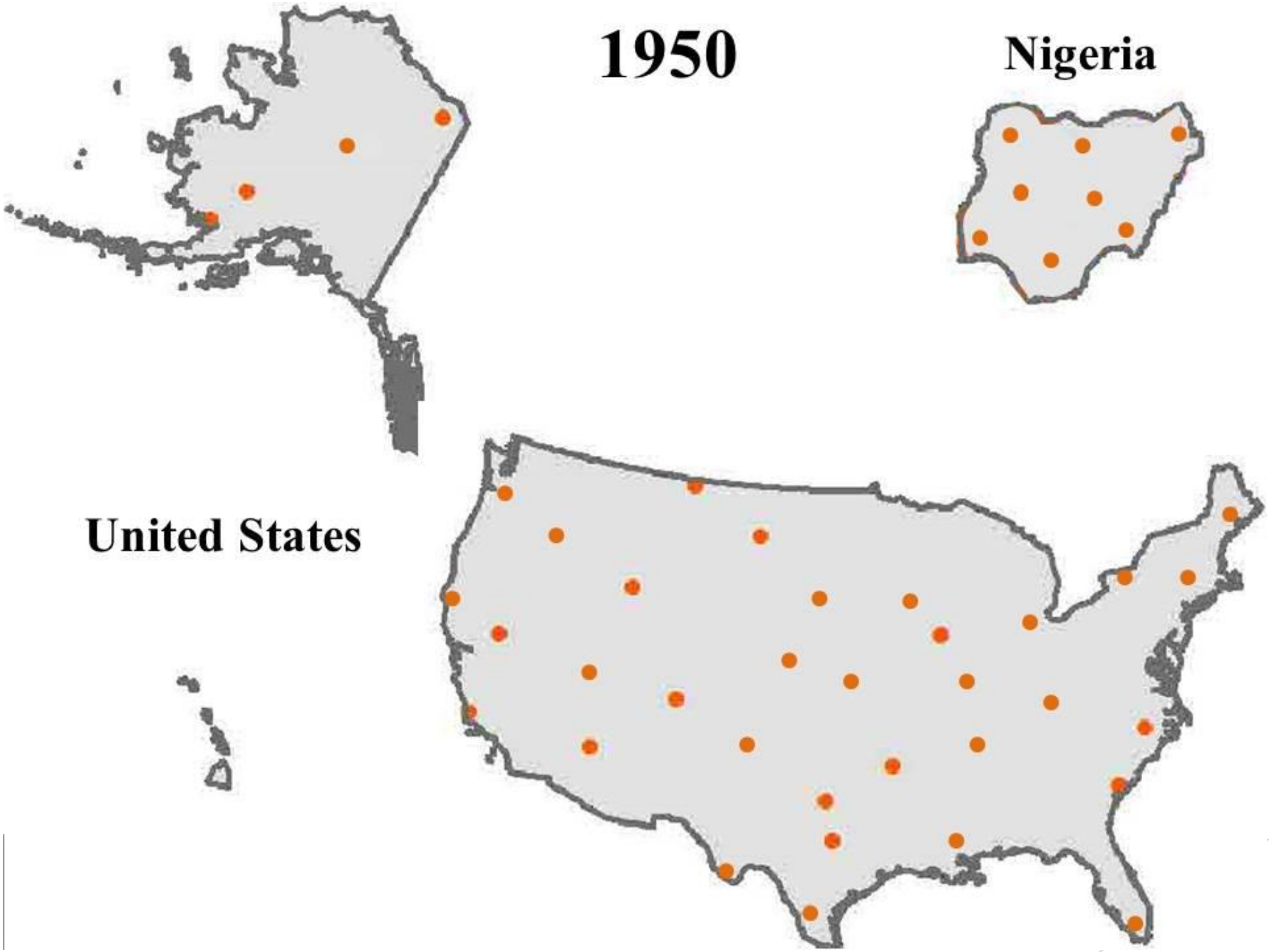
Underlying Problems

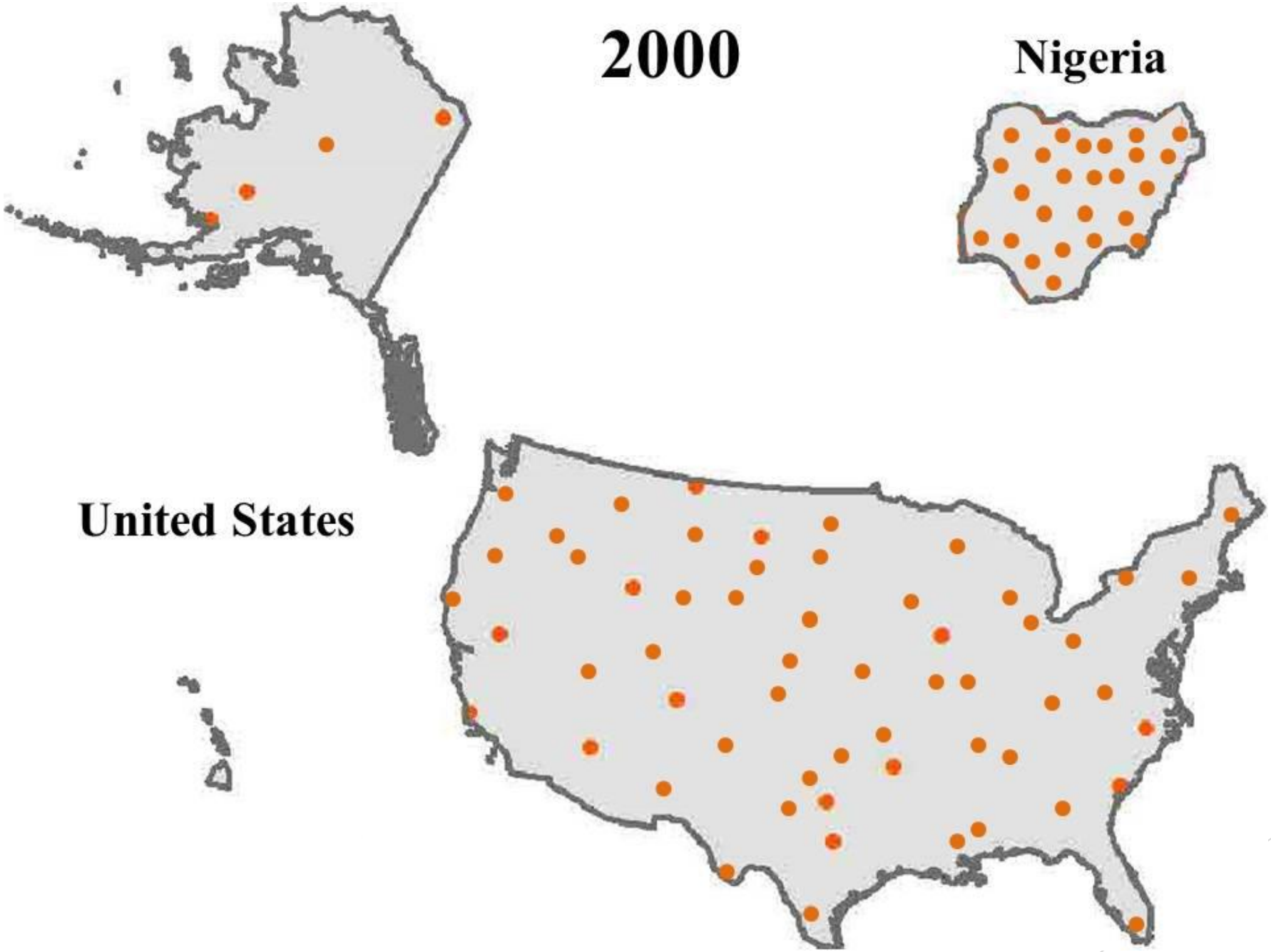
Rapid Population Growth

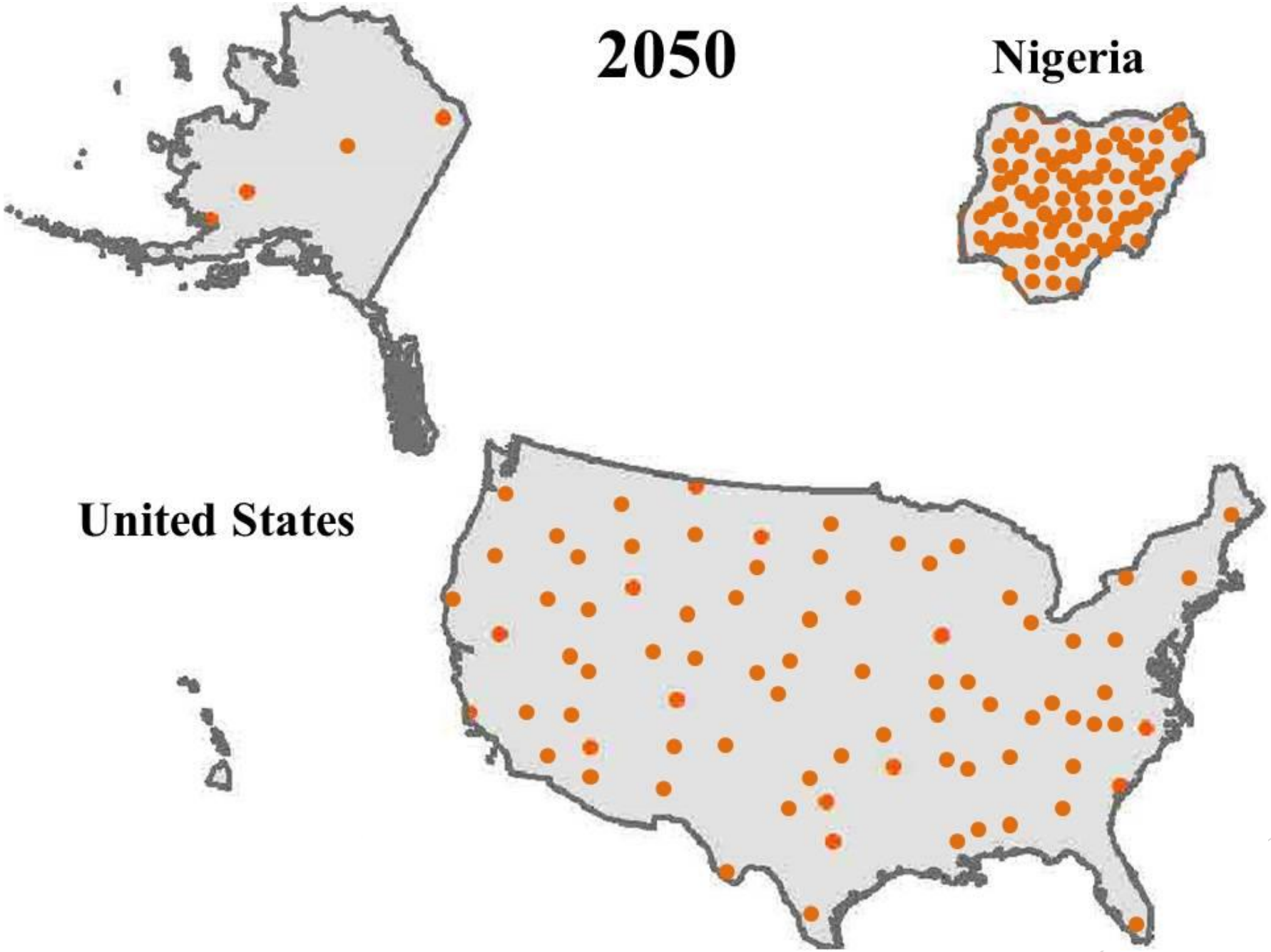
	Land Mass in sq. km.	1950	2000	2050	2100
Nigeria	942,000	38 million	123 million	440 million	914 million
United States	9.8 million	158 million	258 million	401 million	462 million
Percentage of SSA/Global	9.6%	24%	48%	110%	198%

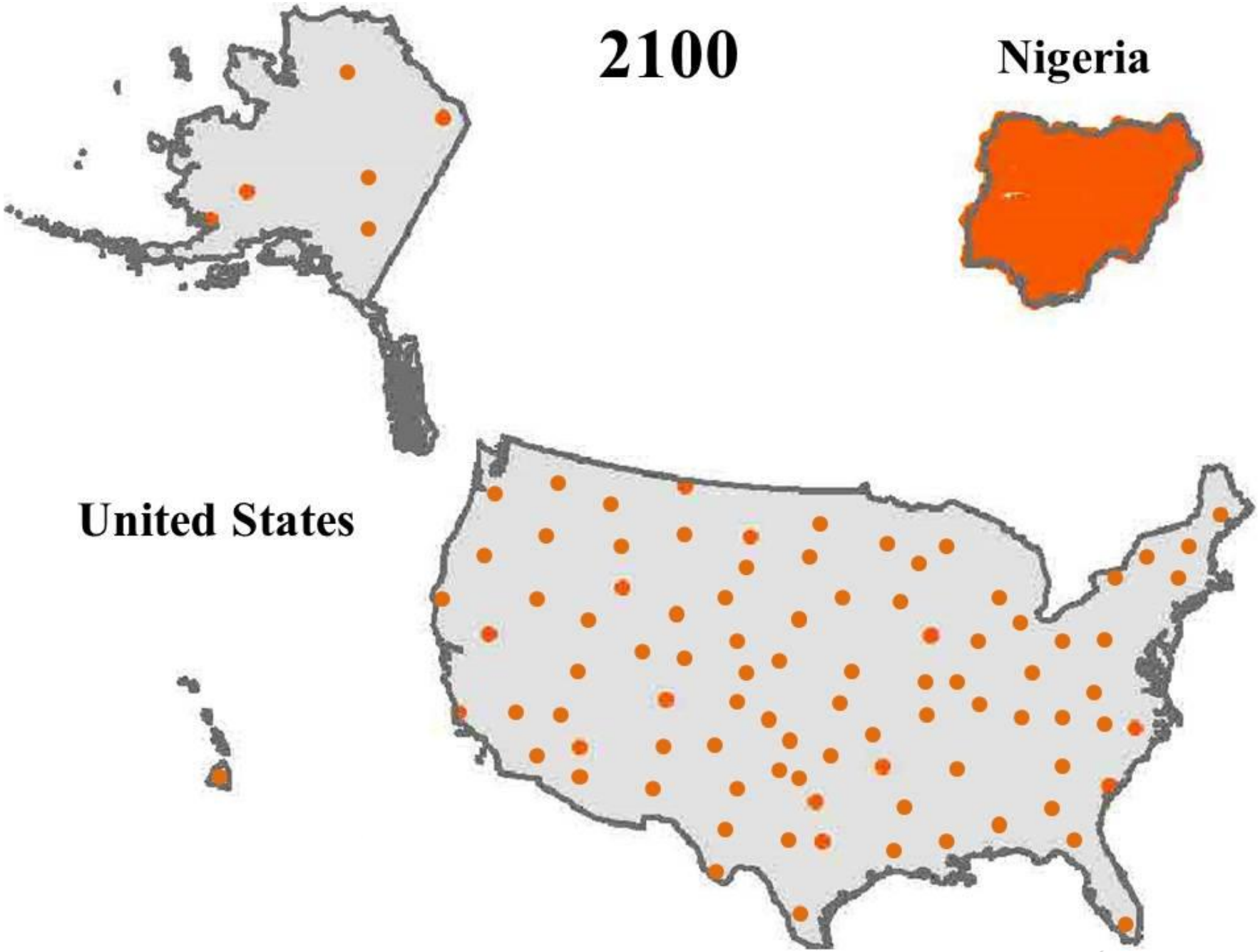
Nigeria & United States Population Growth



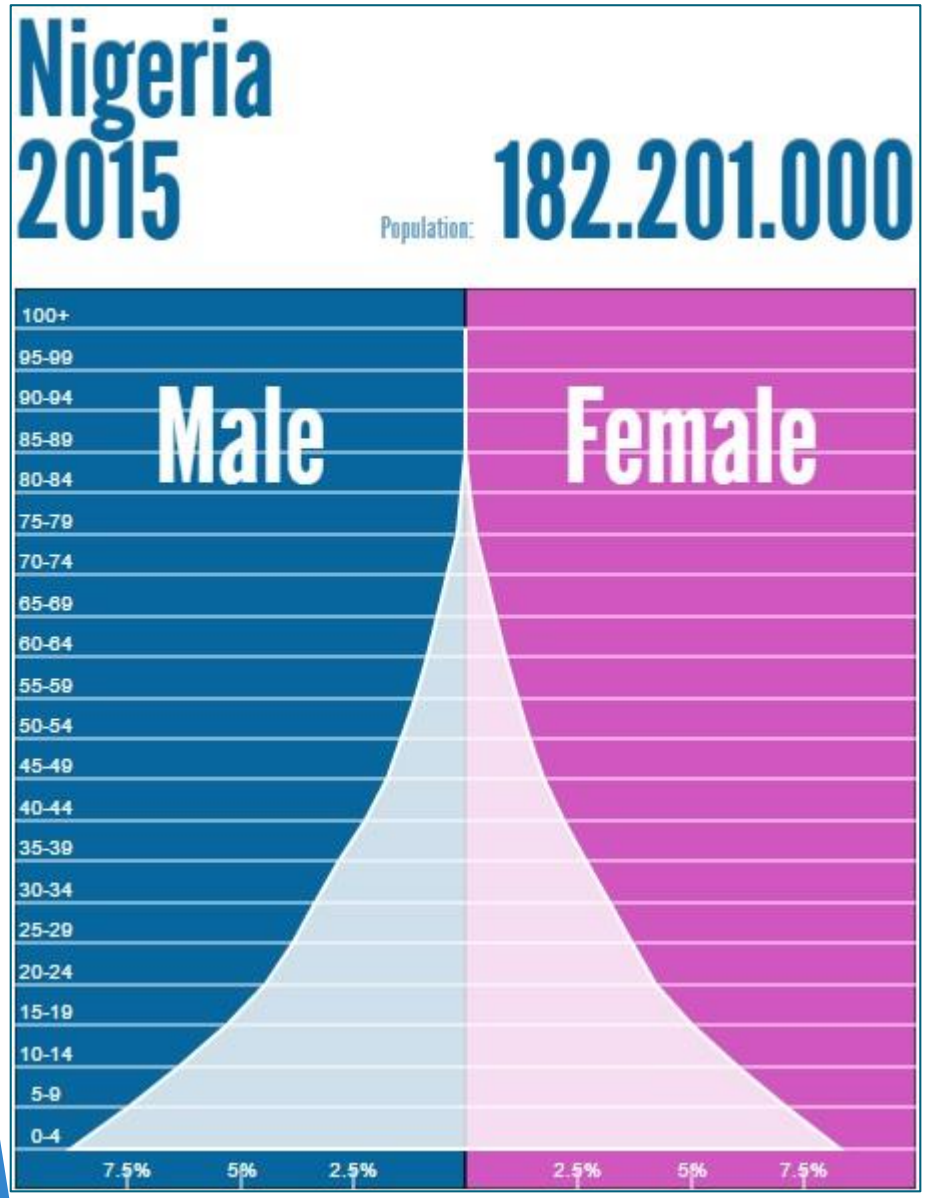

1950
Nigeria
United States

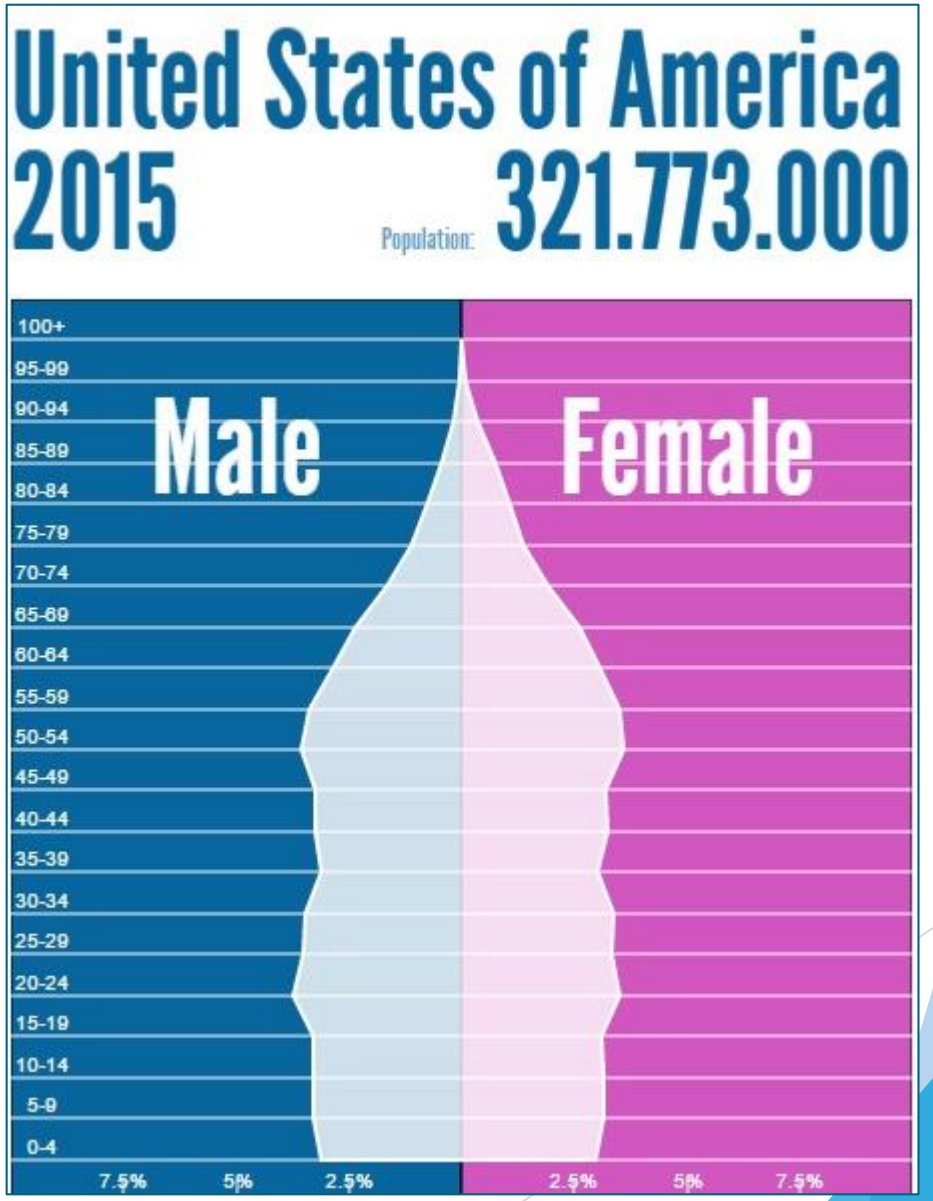

2000
Nigeria
United States


2050
Nigeria
United States


2100
Nigeria
United States

Population Pyramids





Underlying Problems

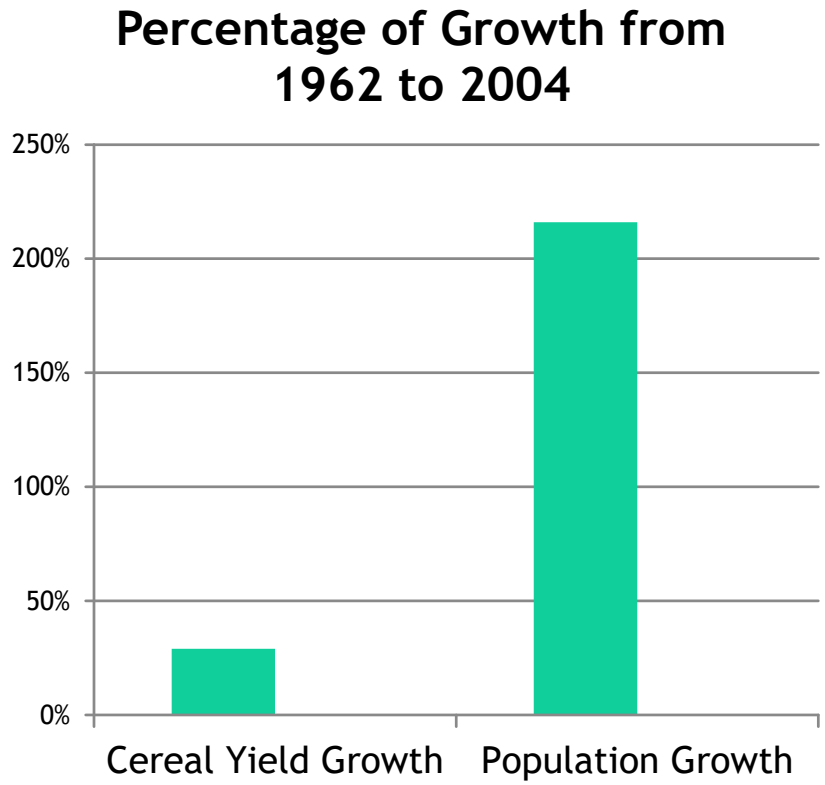
Rapid Population Growth

- Shifts government investment to import food to feed the population while education, health, infrastructure, and economic development suffer
  - Creates cyclical underdevelopment
- Per capita income is reduced
- Buying power is diminished
- Puts stress on natural resources, food security, and environmental degradation

Underlying Problems

Rapid Population Growth

- Decline in per capita crop production
- From 1962 to 2004 SSA cereal yields increased by 29% while the population grew by 216%
- To properly feed the fast increasing population SSA must increase agricultural production by 260% by 2050



Underlying Problems

Rapid Population Growth

- Creates an increase in food demand as well as increased
  - Cultivation of arable and non arable lands
  - Need for milk and dairy products
  - Need for livestock
  - Overgrazing
  - Wood for cooking and lumber for housing construction and furniture
  - Open and deluded lands due to agricultural overgrazing, deforestation, higher erosion flooding sediment and degraded lands

Causes of Underlying Problems

Rapid Population Growth

- About 70% of SSA population depend on subsistence farming
  - Subsistence farming – Family owned and dependent on family members for labor
  - Requires large labor force
- Women are expected to bear a large number of children due to high mortality rate in children
  - High fertility rate of 5.5 children
- SSA population is increasing twice as much as the rest of the world

	SSA	Rest of the World
Population Growth	2.5-3.0%	1.2%
Average # of Children	5.5	2.1

Solutions to Underlying Problems

Rapid Population Growth

- Encourage reduction of Infant and child mortality in an effort to assure parents don't need to conceive a high number of children to assure survival of desired number
- Increase low/no cost access to reproductive health services family planning & contraceptives
- Provide children with greater access to education and more importantly maximize educational opportunities to girls
- Increase the number of females attending school early and stay in school as long as possible

Source: Teachers Without Boarders, 2009

Solutions to underlying problems

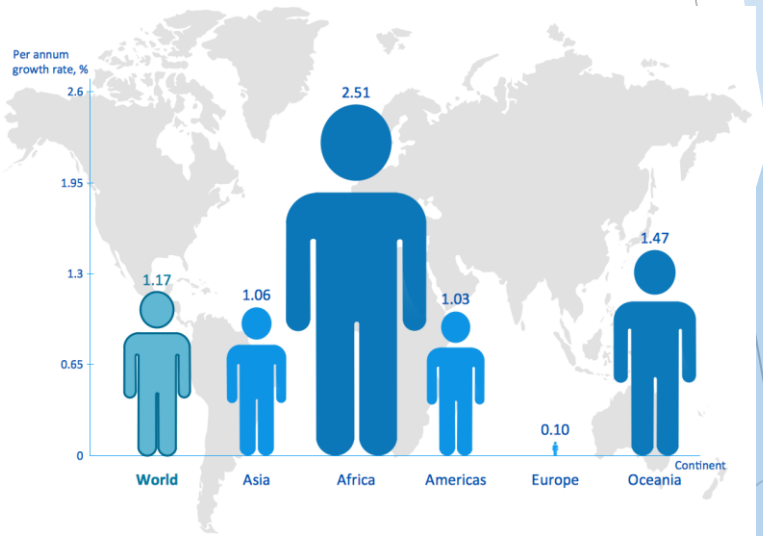
Rapid Population Growth

- Avoid pregnancies that are too early, too late, and too many
- Delay married life and child bearing
- In many parts of the subcontinent, woman have little choice in the decision of child bearing
- Gender equality is mainly through education

Solutions to underlying problems

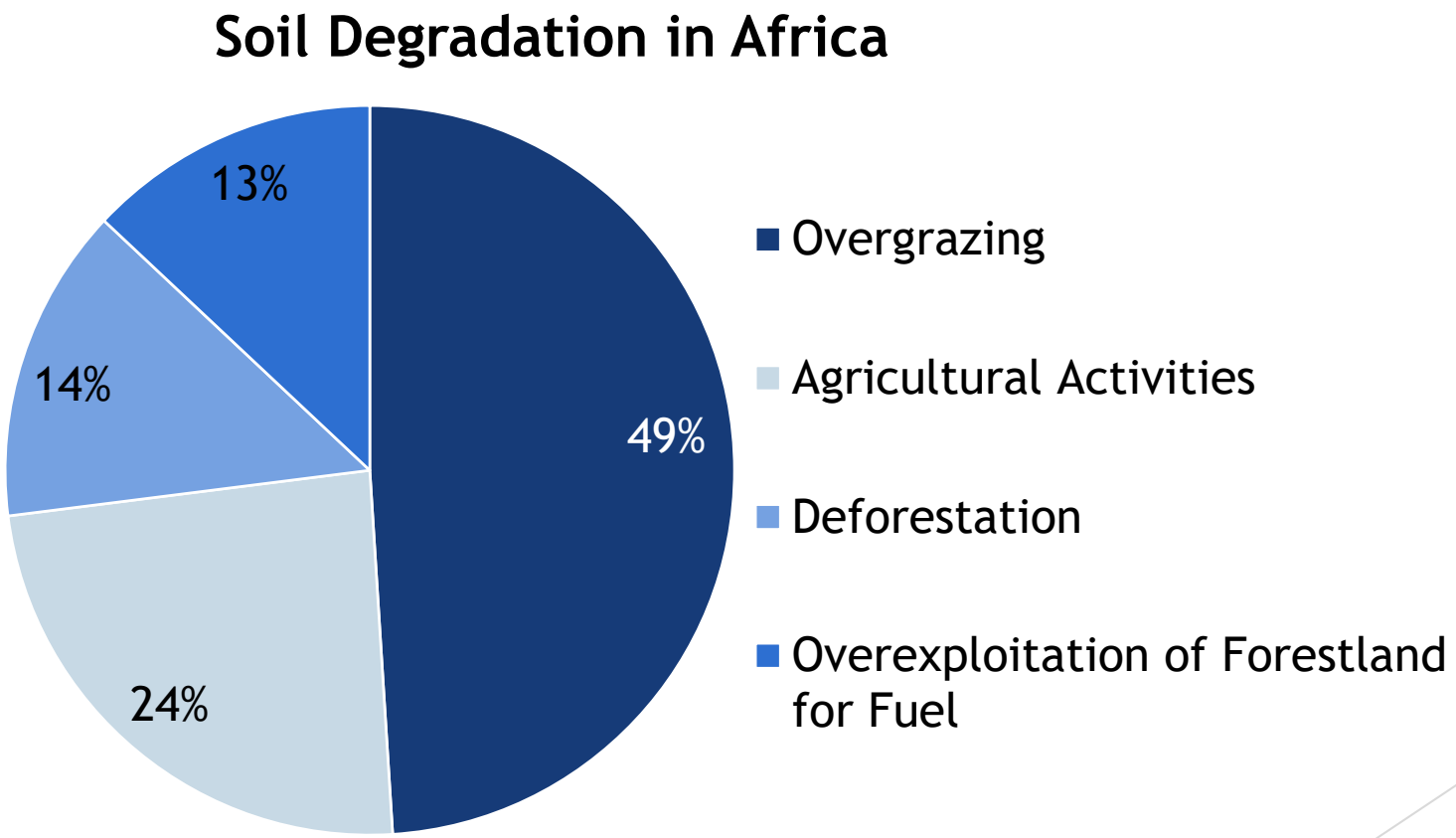
Rapid Population Growth

- In the past, rapid population was not addressed because the subcontinent is vast, low population densities and abundance of resources, the reality is changing dramatically
- In Latin America and Asia, access to family planning, education, and legal reforms have stabilized population growth to a population growth of about 1.2%
- Reduce fertility rate from 5.5 to 2.1 (fertility replacement level)



Underlying Problems

Degradation of Natural Resources and the Environment



Underlying Problems

Degradation of Natural Resources and the Environment

In SSA, the main causes of degradation and desertification are over-cultivation, deforestation, and overgrazing

- The UN estimates about 1/3 of dry lands are affected by desertification as a moderate or high degree.
- 73% of the total agriculturally used drylands are already degraded
- According to UNEP in 1991, about 61% of the continent's rainfed crops, 18% of the irrigated lands and 74% of its rangelands are affected by desertification at a moderate or high degree
- As of 1992, about 1/3 of the total agriculturally used dry lands in Africa have lost about 25% of their productive capacity

Causes of the Underlying Problems

Degradation of Natural Resources and the Environment

Source: BBC, 2014. Desertification in Africa.

- As a result of population growth agricultural lands are expanded
  - Increased Exposed lands to wind and water erosion
  - Over-cultivation
- Desertification taken place due to mismanagement of resources and climate variability
- Due to rapid population growth, number of livestock is increasing
  - Little or no plans, grazing management and regulations, and enforcement
  - Overgrazing of range lands and post harvest crop residue
  - Overgrazing increases erosion and compaction of soil

Causes of the Underlying Problems

Degradation of Natural Resources and the Environment

- Deforestation
  - Higher demand for fire wood and building material and furniture
  - Construction of roads in forest areas
  - Expansion of agricultural lands into forest lands
  - Increased export of forest products

Source: Africa Reporter, 2015. Deforestation in Tanzania

Causes of Underlying Problems

Degradation of Natural Resources and the Environment

- Farming Practices
  - Mismanagement of soil where little or no organic matter is developed on farm lands
  - Development of agriculture lands without undertaking land classification
  - Over cultivation causing erosion, loss of top fertile soil and damage soil structure, compact soils, reduced permeability, resulting in reduction of moisture movement in the crop root zone
  - Exposing farm lands with little or no soil cover

Causes of Underlying Problems

Degradation of Natural Resources and the Environment

- Due to shortage of cultivable lands, fallowing of lands is not practiced
- Very little use of fertilizers
- Little or no planning and management of watershed
- As a result of rapid population growth, steep lands are developed for agricultural production, thereby increasing runoff and erosion
- Allowing livestock graze right after harvest
- Cropped lands are divided and re-divided

Solutions to Underlying Problems

Degradation of Natural Resources and the Environment

- Education
  - Farm management
  - Soil classifications
  - Crop relationships
- Policies and regulations
  - Grazing
  - Logging
  - Increase crop yield and reduce expansion of cropped land

Source: Future in Our Hands International Network. 2015. School in Cameroon with hands on education about tree planting.

Underlying Problems

Lack of accumulated knowledge

- Archaic farming practices passed from generation to generation
- Inefficient farm management
- Lack of sufficient qualified farm extension agents
- No financial consultants or credit available to improve farm profits

Underlying Problems

Lack of accumulated knowledge

- 70% of SSA population is engaged in agricultural production compared to a mere 2% in the United States
- Outdated farming practices focused on subsistence farming
- Reliance on conventional rainfed systems

Causes of Underlying Problems

Lack of accumulated knowledge

- SSA education system is based on Colonial era systems
- A large portion of the labor force is permanently stunted causing low productive capacity
- 80% of the poor live in rural areas
  - dependent on subsistence farming
  - Insufficient agricultural training of science based farming practices is provided small rural farmers
- Lack of communication of successful farming practices based in science

Causes of Underlying Problems

Lack of accumulated knowledge

Lack of:

- Adequate roads
- Science and technology based knowledge to pass from one generation to the next
- Mastering their environment
- Knowledge in soil-water-climate-plant relationship
- Knowledge on how crop productivity can be increased with proper use of organic and inorganic fertilizers
- Identifying and controlling weeds, insects, and diseases

Solutions to Underlying Problems
Lack of accumulated knowledge

Source: Agroecology Fund, 2016.

- Category I – Onsite training for small rural farming communities
  - Land leveling techniques
  - Conserving and storing runoff in storage ponds
  - Irrigation needs of crops
  - Detecting and controlling crop disease, pests and weeds
- Category II – After completion of 8th grade; Initially 60% of students
  - Train vocational and technical students in establishing and operating small and medium businesses in rural SSA
  - Agricultural and nonagricultural
  - Energy, water, communication, construction, service industry, management

Solutions to Underlying Problems

Lack of accumulated knowledge

- Category III – After completion of 10th grade; Initially 30% of students
  - 4 consecutive years
  - Planning, design and construction of small and medium dams
  - Farm, forestry, grazing, and watershed management
  - Renewable energy systems
  - Advanced nursing
- Category IV – Comparable to university level education; Initially 10% of students
  - Advanced studies to support economy at senior management, research and operational levels in production of goods and services
  - Development of local materials for small scale and heavy manufacturing
  - Agricultural sciences and agronomic research

Underlying Problems

Inadequate Domestic Crop Production

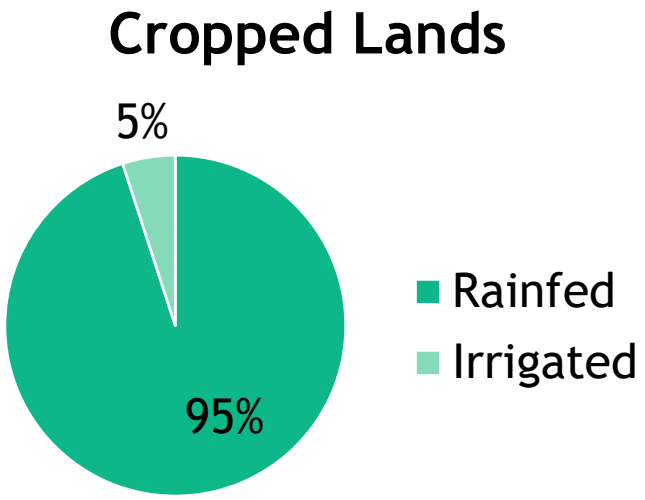
- Low crop yields
- Lack of knowledge
- Subsistence farming practices
- Degraded soils
- Not realizing that soil is living
- Negative impacts from climate change
- Women's role in agriculture

Source: Oakland Institute, 2011

Underlying Problems

Inadequate Domestic Crop Production

- Stagnant crop production in SSA
  - Insufficient water
  - Deficient soil nutrients
  - Diseases, pests, weeds
  - Degraded agricultural land, primarily the thinning or depleting top fertile soil
- Arid, semi-arid sub-humid climate
  - Frequent droughts
- Subsistence farming
- Barriers to high crop production include both forces of nature and man



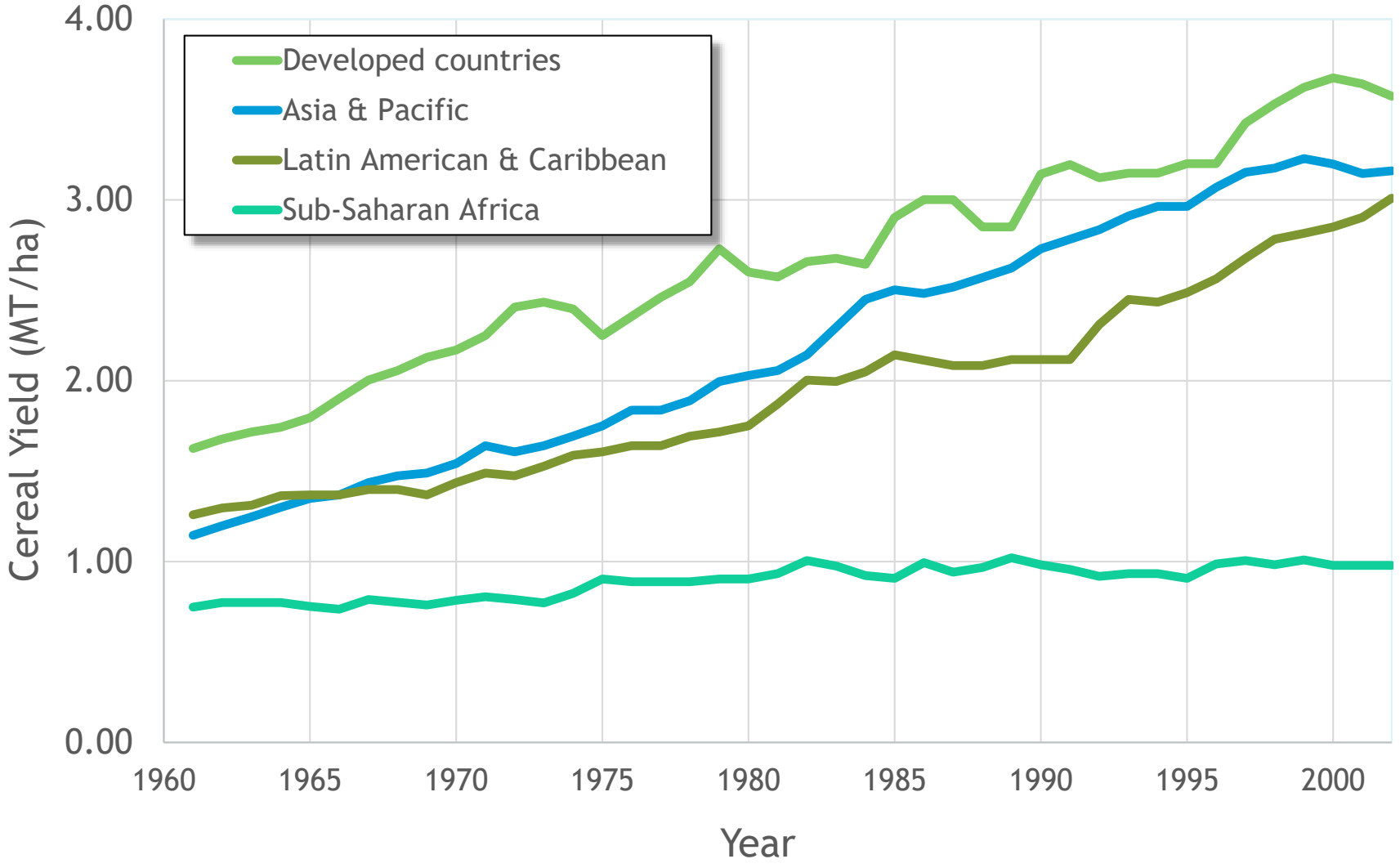
Underlying Problems

Inadequate Domestic Crop Production

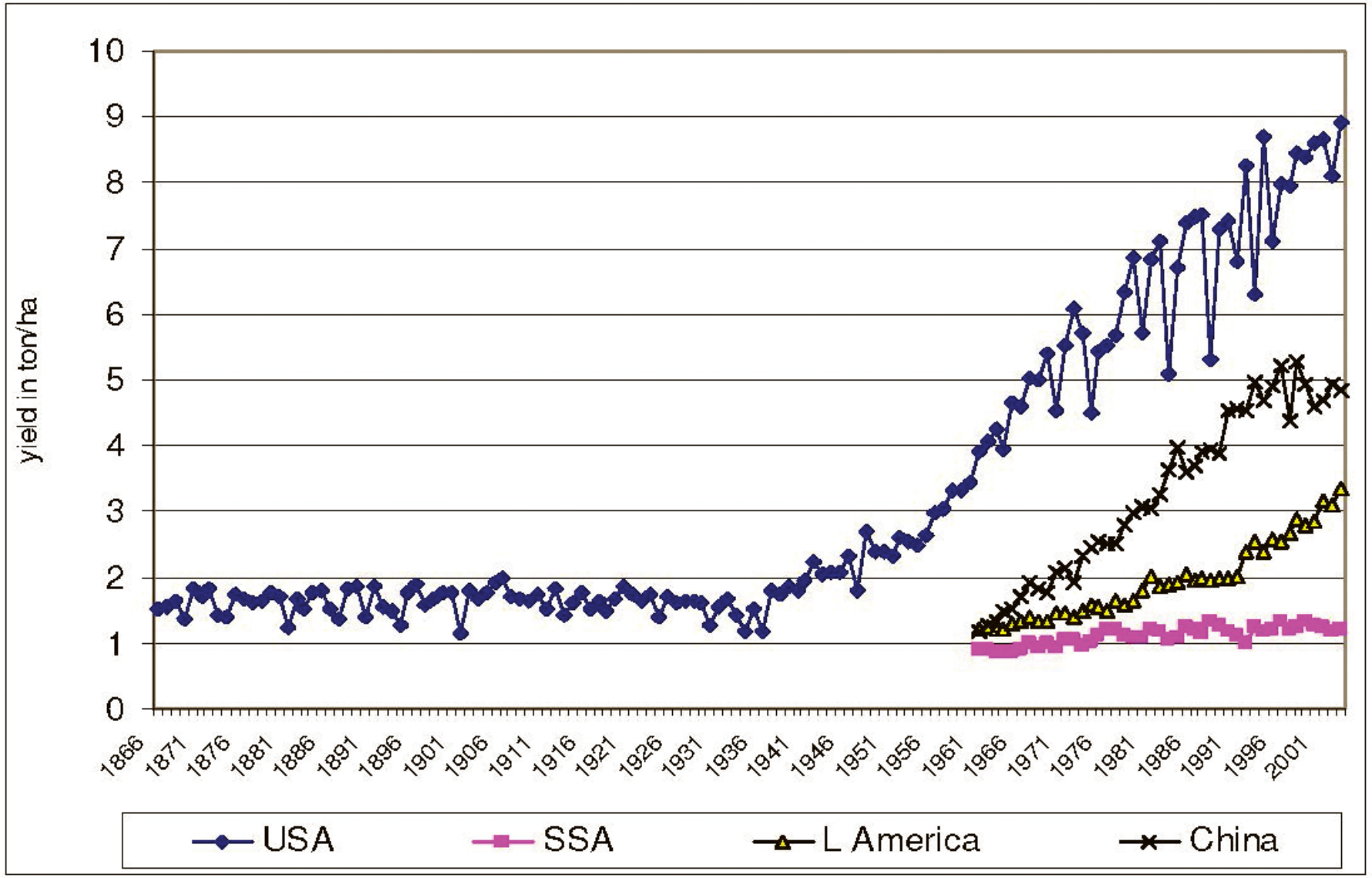
Climate Change

- Increasing temperatures will increase the crop demand for water
- East Africa regions expect high intensity and torrential rainfall
- South Africa regions expect low rainfall and dry climate
- As a result of excessive mismanagement and misuse of natural resources, conventional rainfed agriculture will be improper as a crop production method

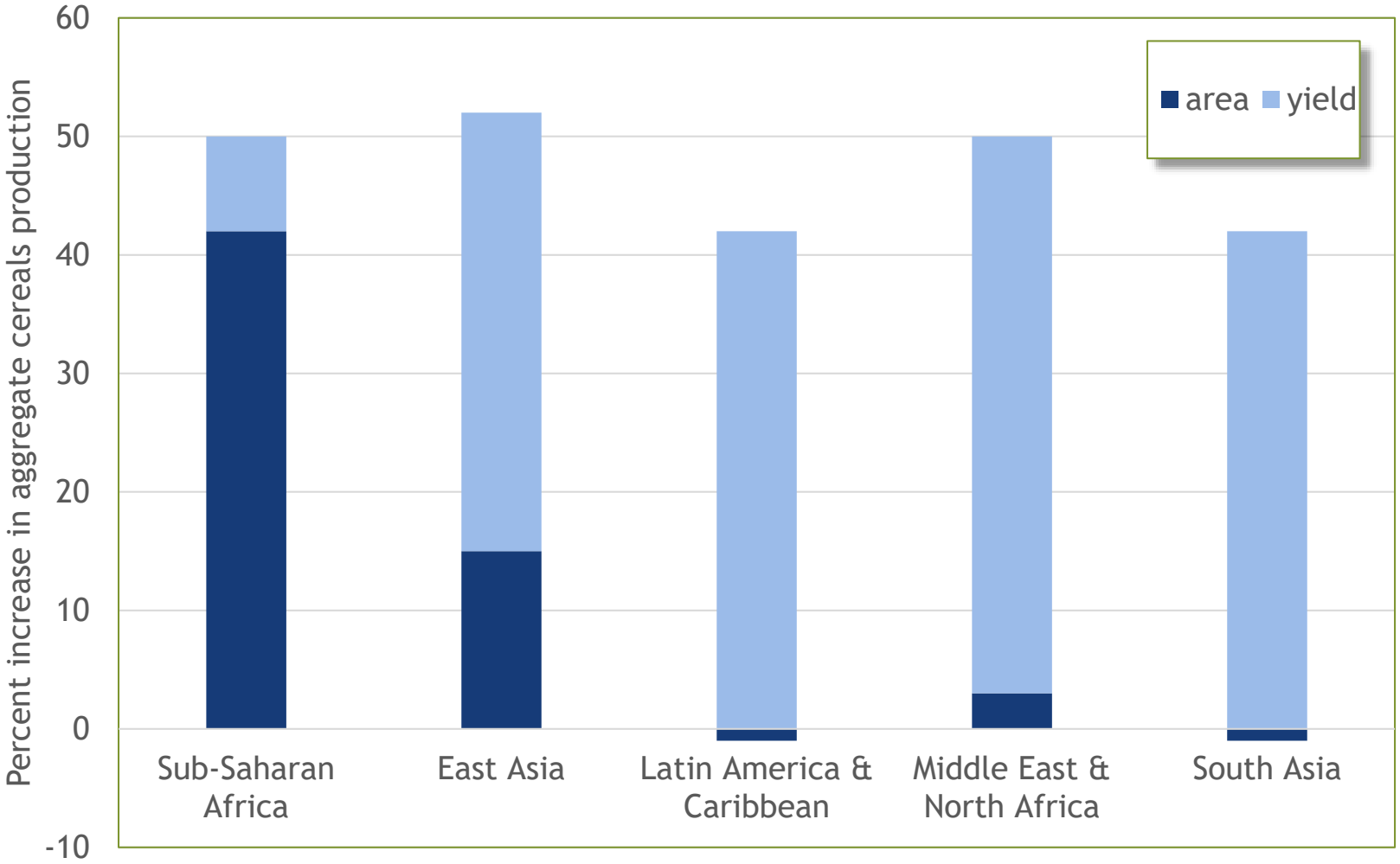
Grain Yields



Maize Yields



Cereal Production Trends: 1980 - 2003



Causes of the Underlying Problems

Inadequate Domestic Crop Production

Lack of:

- Restoring degraded agricultural, range, and forest lands
- Maintaining healthy soils
- Undertaking crop establishment
- Planting adaptable crops
- Selecting appropriate high yielding seeds
- Providing crops with necessary organic and inorganic nutrients
- Controlling pests, weeds, diseases, and insects
- Undertaking integrated watershed and natural resources management

Solutions to Underlying Problems

Inadequate Domestic Crop Production

- Increasing crop yields instead of cropped lands
- Satisfying crop moisture requirements
  - At the farm level by leveling, contouring, and terracing
  - Harvested runoff
  - Small and medium dams
- Reengineered rainfed crop production (RRCP)
  - Making water available to cropped lands at the small-farm level from all conceivable source of water supply, in addition to direct rainfall
  - Ensures adequate amount of moisture is stored in the root zone

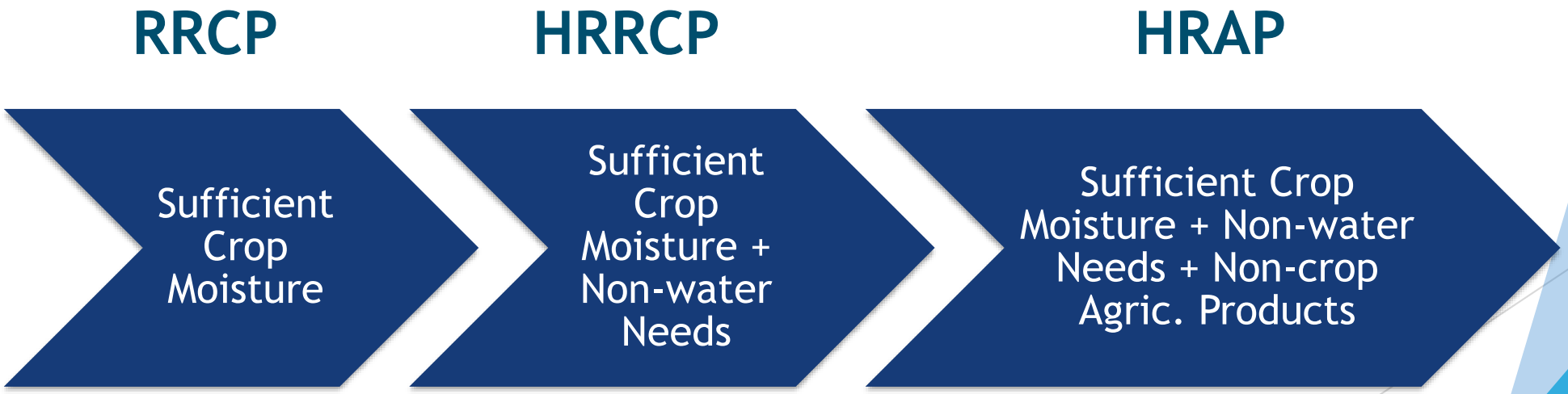
Solutions to Underlying Problems

Inadequate Domestic Crop Production

- The goal is to produce moderately high crop production (MHCP) or modified crop production technology (MCPT)

Staged Management Schemes

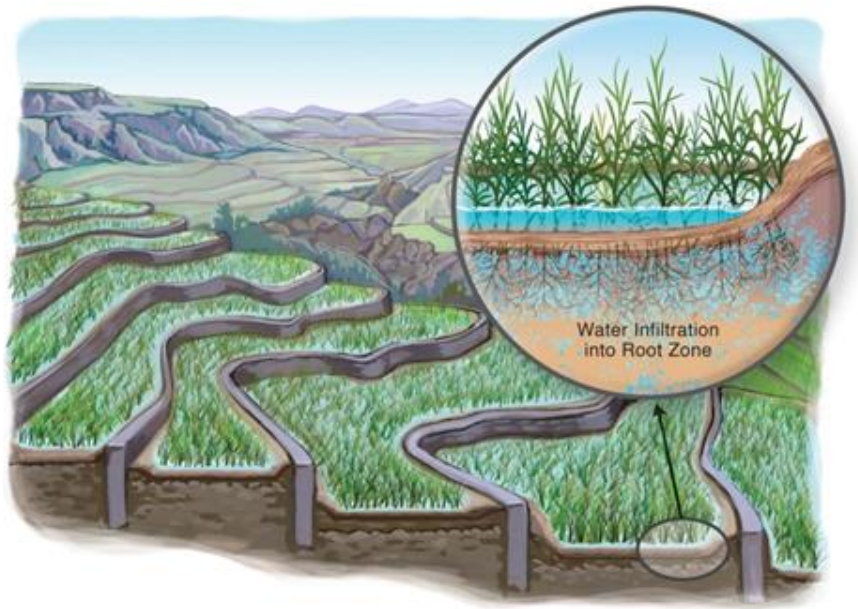
1. Re-engineered rainfed crop production (RRCP)
2. Holistic re-engineered rainfed crop production (HRRCP)
3. Holistic re-engineered agricultural production (HRAP)



Reengineered Rainfed Crop Production

- Maximizing the availability of soil moisture

Goal: Prevent runoff and maximize rainfall infiltration

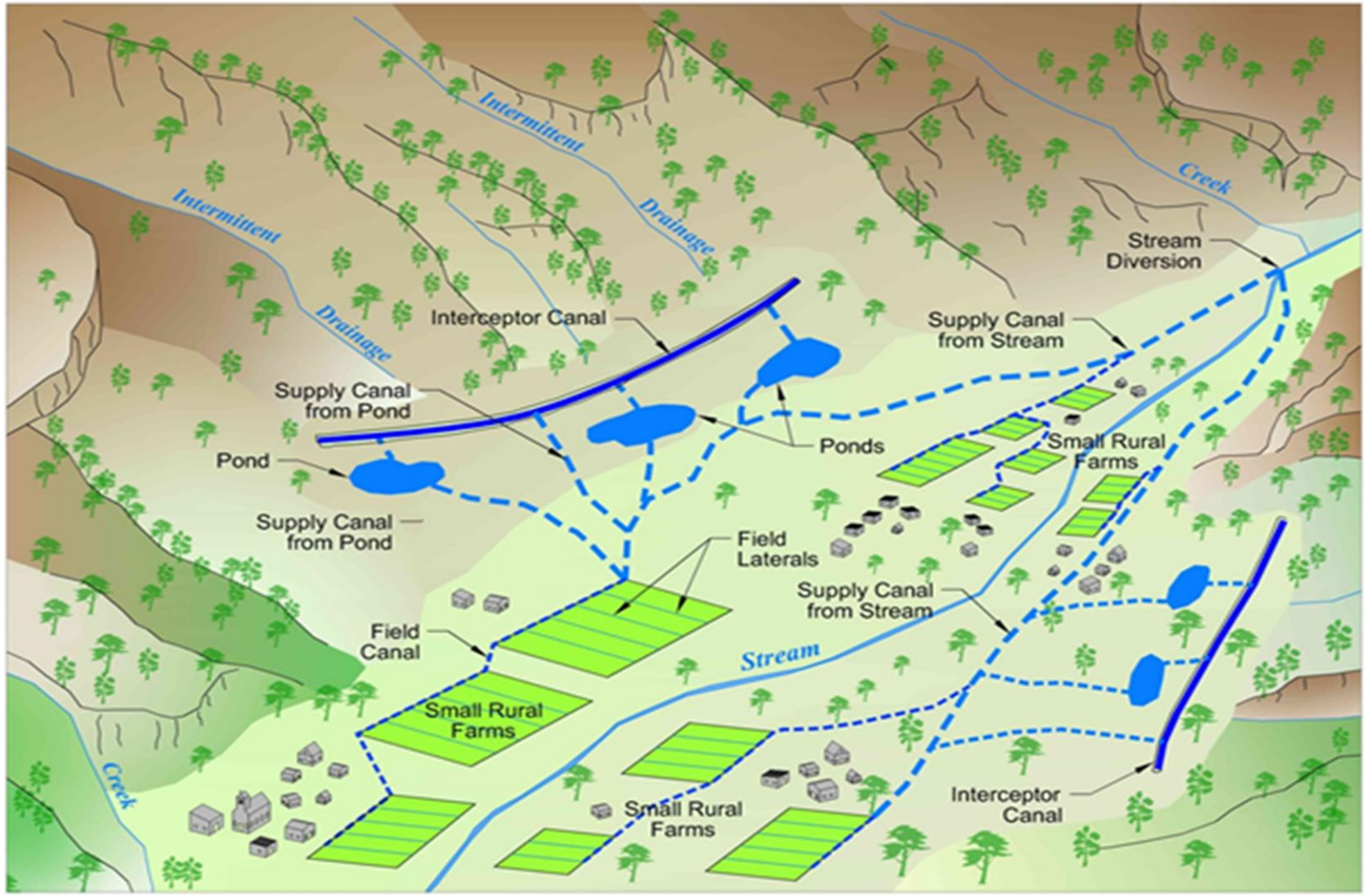


Level terrace contour basin

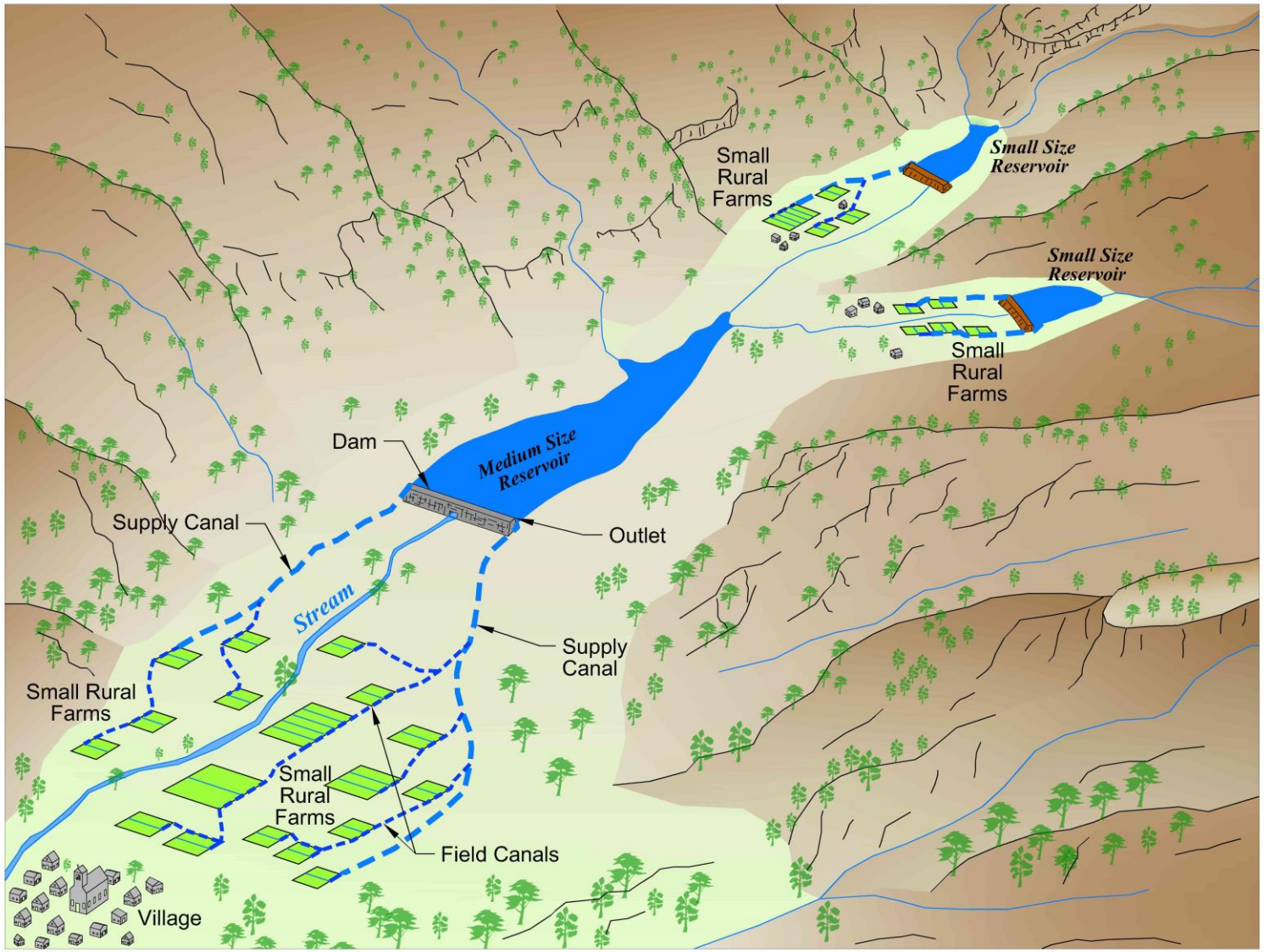
Reengineered Rainfed Crop Production

Methods for Optimizing Moisture Availability at Farm-Level	
Leveling, Terracing, Contouring	Fallowing
Berms to retain runoff	Maximize organic matter
Mulching	Minimize tillage
Crop cover	Select appropriate seeds

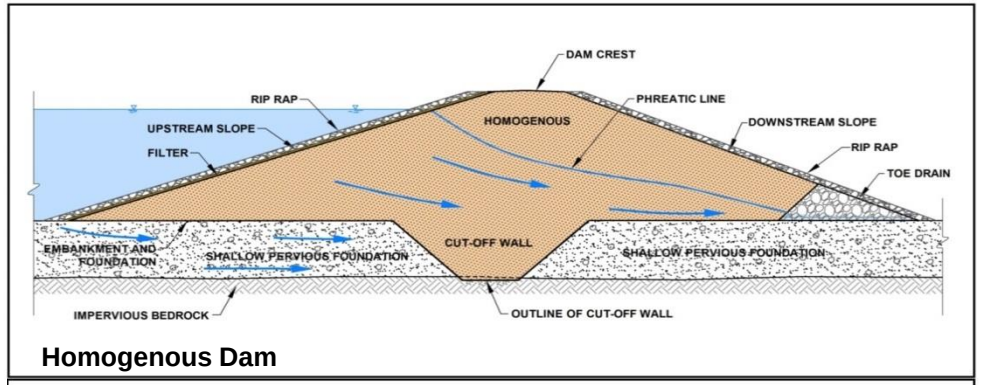
Supplemental Irrigation Based on Harvested Runoff



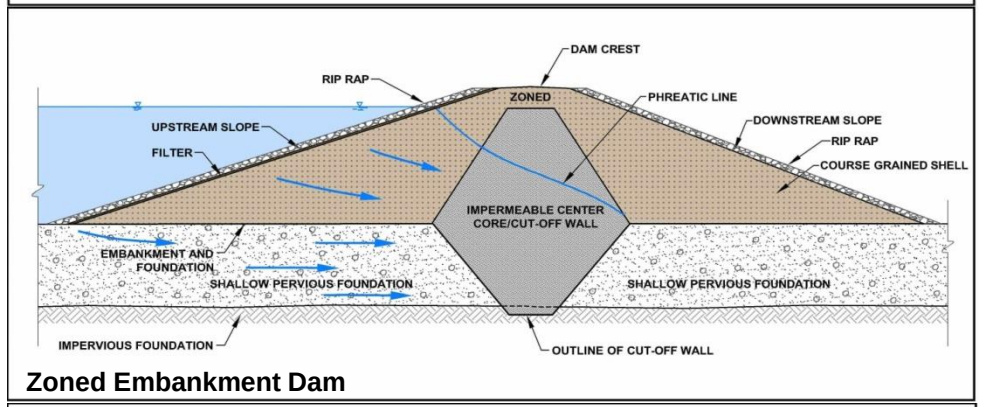
Small-scale Irrigation Based on Small and Medium Dams



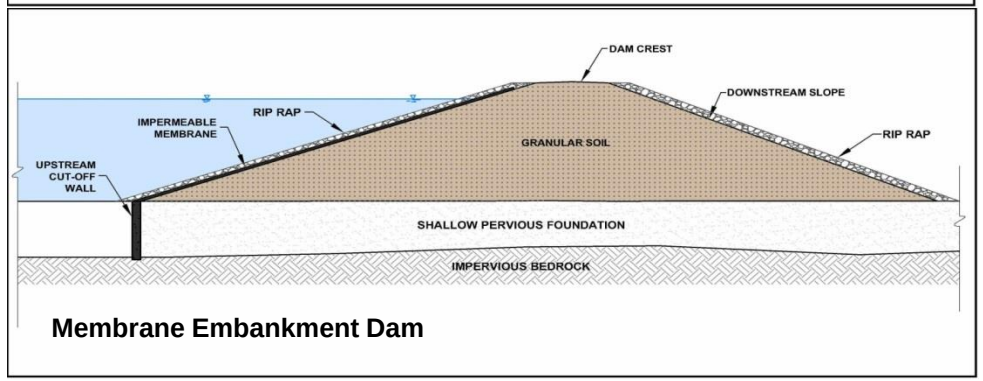
Reengineered Rainfed Crop Production



Homogenous Dam



Zoned Embankment Dam



Membrane Embankment Dam

Release of water from small and medium earthen dams are appropriate only after other methods have proved insufficient

Knowledge of water resources analysis, water demand quantification and soil mechanics is a prerequisite for dam construction

Full Service Irrigation Systems

Surface Irrigation: most common method

Sprinkler Irrigation: expensive and heavy O&M

Drip Irrigation: potentially the most efficient

Holistic Reengineered Rainfed Crop Production

- Holistic reengineered rainfed crop production (HRRCP) also known as modified crop-production technology (MCPT) follows
  - HRRCP Transforms SSA rural farmers from subsistence crop production to surplus crop production
  - Combined with proper watershed management, holistic reengineered agricultural production (HRAP) can be achieved and thus maximum agricultural output

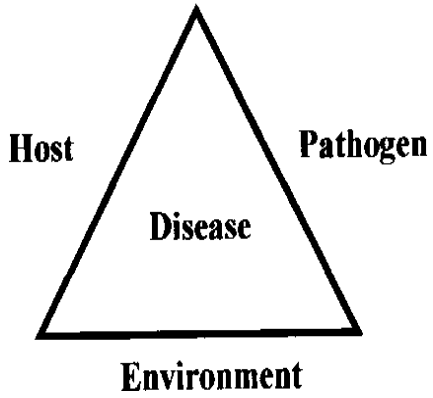
Holistic Reengineered Rainfall Crop Production

- HRRCP focuses on the management crop non-moisture needs as well, such as:

Crop Nutrients

Courtesy of: Cropnutrients.com

Insects, Pests, & Diseases

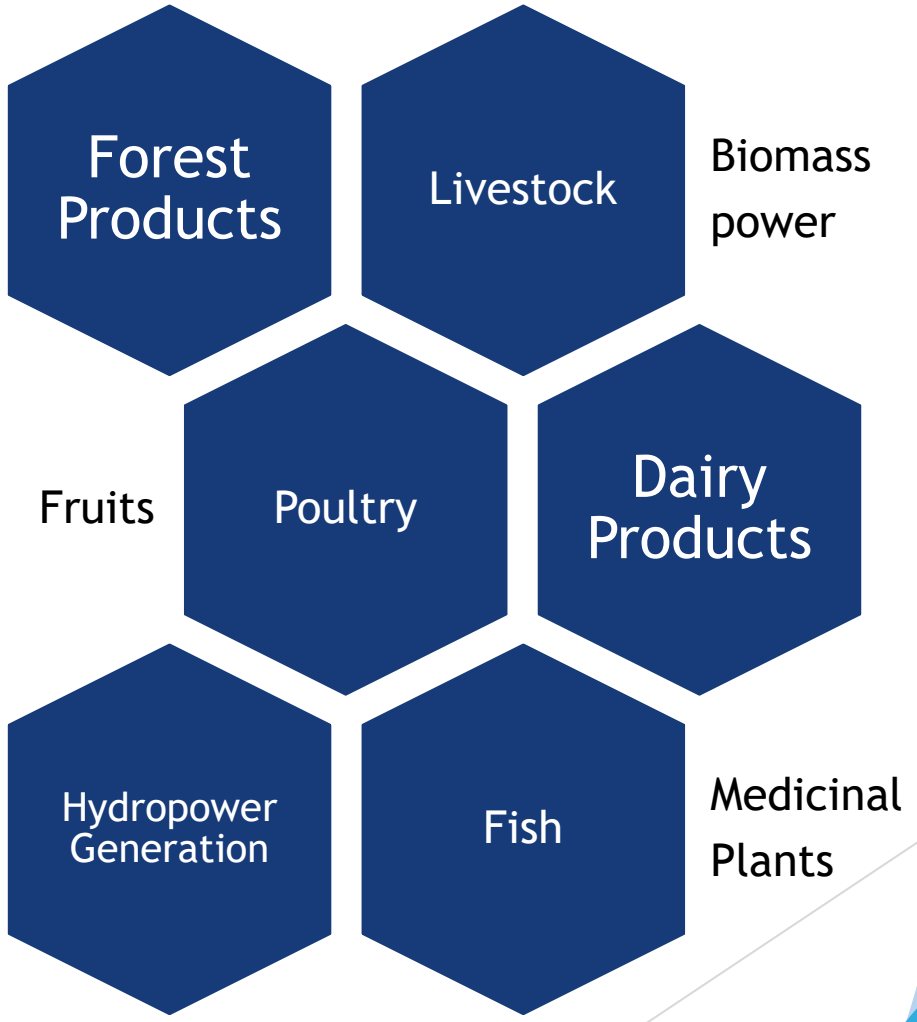


Weed Management

Courtesy of: agritech.tnau.ac.in

Holistic Reengineered Agricultural Production

The capability to produce MHCP and other products such as:



…for a more sustainable, diverse, and stable SSA.

Restoration and Maintenance
of natural resources

- Degradation of fertile land reduces available water
  - Surface runoff inhibits soil moisture and nutrient holding capacities
- Integrated land use plans of natural resources of watersheds
  - Protection
  - Maintenance
  - Restoration

Rangeland Management

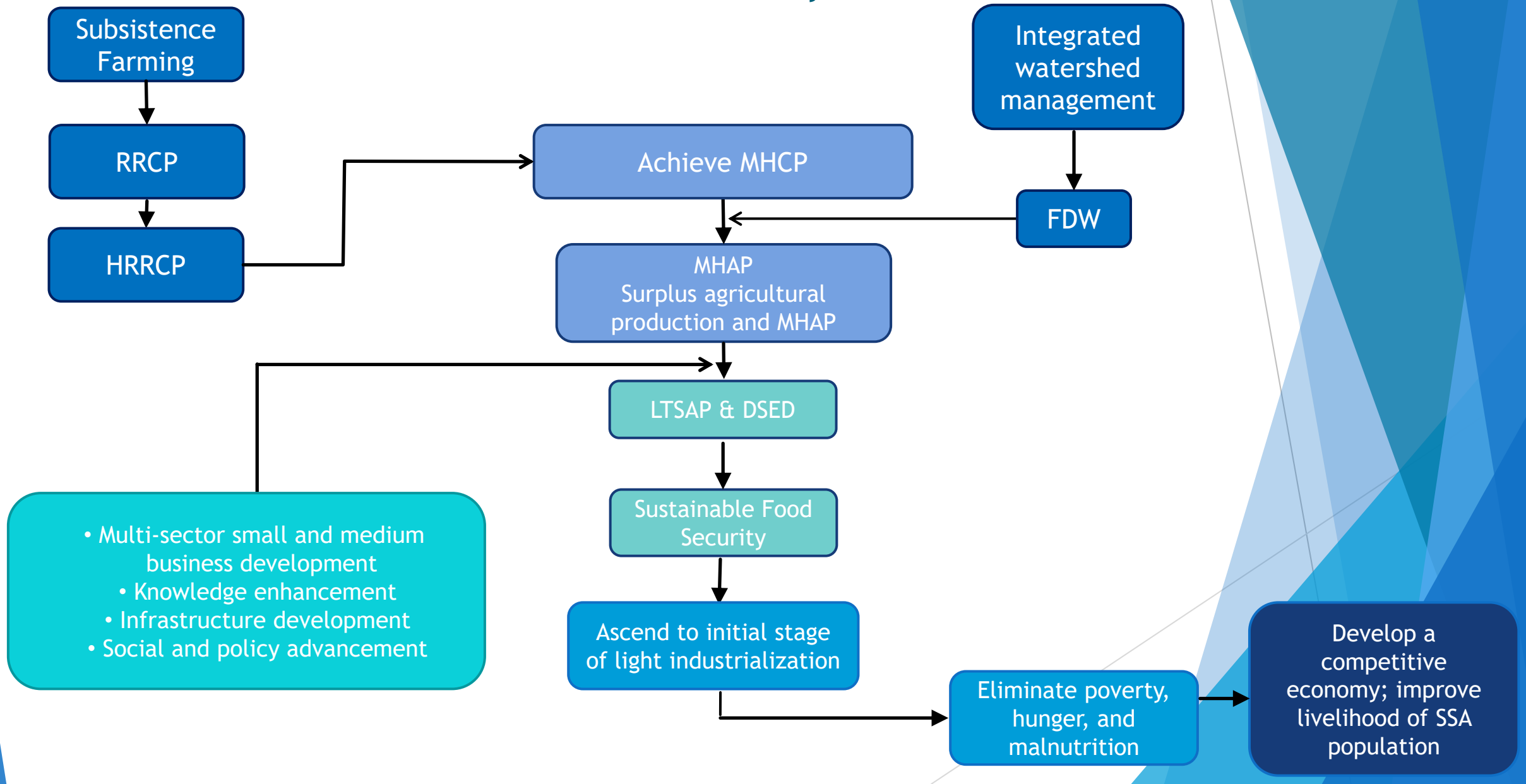
Cleared Hillside: Prone to Erosion

Successful tree planting in Eritrea

Stream Erosion

Treated Steam

Transformation of Agricultural Development from Subsistence Farming to Sustainable Food Security

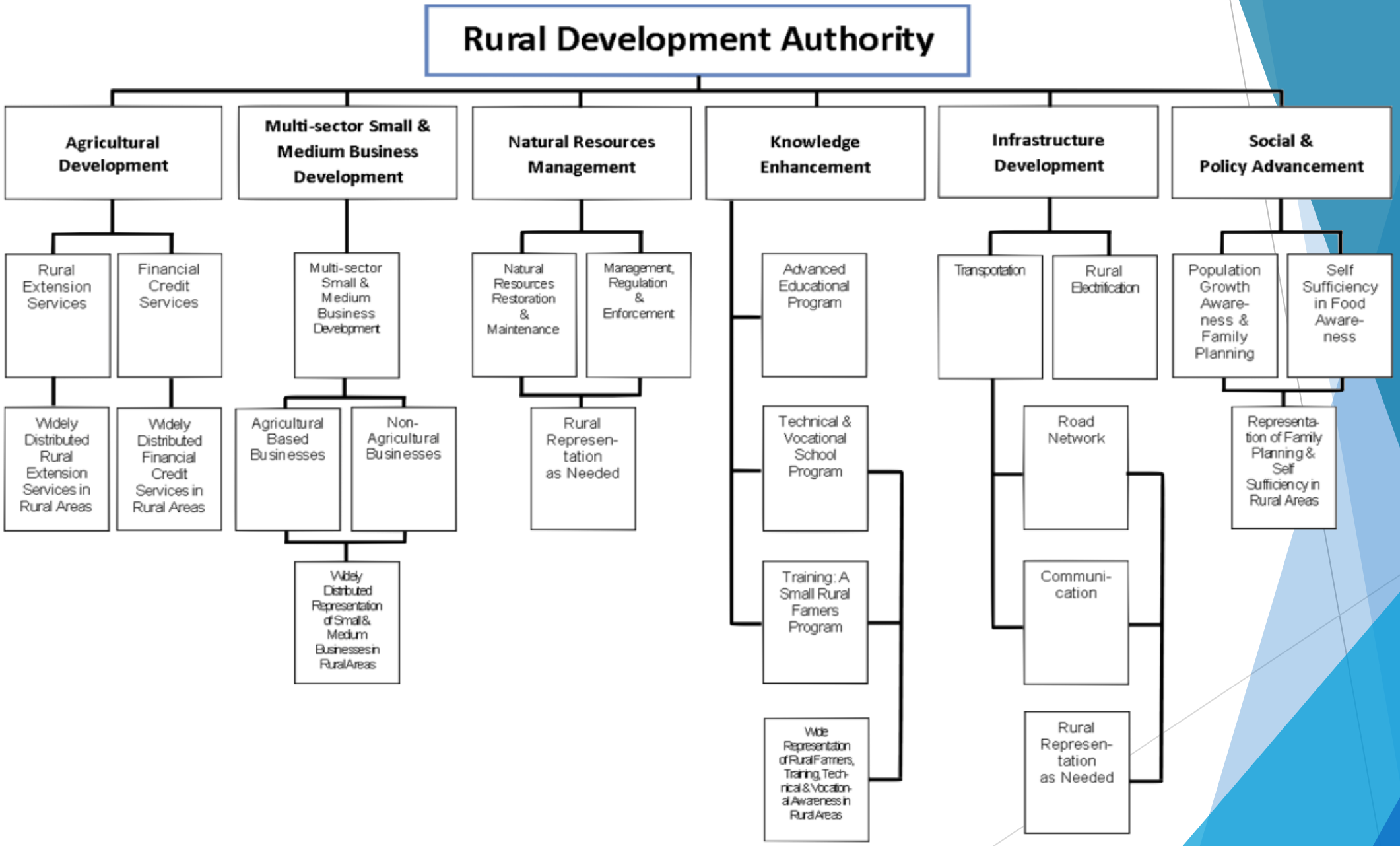


Implementation of solutions

- Establishment of Rural Development Authority (RDA)
  - Shift development priorities from urban to rural regions
  - Need for diversification of rural economies
  - Gain economic sovereignty

Rural Development Authority
(RDA)

- Proposed new sector of the government that implements and maintains programs that foster the adoption of MCPT and MAPT with the end goal of DSED
- 6 major departments with branch offices in the rural countryside
  - Agricultural Development
  - Integrated Natural Resources Management of Watersheds
  - Multi-Sector Small and Medium Business Development
  - Knowledge Enhancement
  - Infrastructure Development
  - Social and Policy Advancement


Rural Development Authority
Agricultural Development
Rural Extension Services
Financial Credit Services
Widely Distributed Rural Extension Services in Rural Areas
Widely Distributed Financial Credit Services in Rural Areas
Multi-sector Small & Medium Business Development
Multi-sector Small & Medium Business Development
Agricultural Based Businesses
Non-Agricultural Businesses
Widely Distributed Representation of Small & Medium Businesses in Rural Areas
Natural Resources Management
Natural Resources Restoration & Maintenance
Management, Regulation & Enforcement
Rural Represen-tation as Needed
Knowledge Enhancement
Advanced Educational Program
Technical & Vocational School Program
Training: A Small Rural Famers Program
Wide Representation of Rural Farmers, Training, Tech-nical & Vocation-al Awareness in Rural Areas
Infrastructure Development
Transportation
Rural Electrification
Road Network
Communi-cation
Rural Represen-tation as Needed
Social & Policy Advancement
Population Growth Aware-ness & Family Planning
Self Sufficiency in Food Aware-ness
Representa-tion of Family Planning & Self Sufficiency in Rural Areas

Rural Development Authority Branches
Agricultural Development

- Ensure small rural farmers are able to produce moderately high crop productions through the management schemes of RRCP, HRRCP, Food derived from watersheds (FDW), and HRAP
- Two sub departments
  - Rural Financial Credit Services
  - Rural Extension Services

Rural Development Authority Branches
Knowledge Enhancement

- Educational reform is necessary
- Adoption of farming techniques based on science and technology
- Education based on specific and relevant skills
- Investments in school’s curricula and training programs

Rural Development Authority Branches

Integrated Natural Resources Management of Watersheds

- Administer, regulate, and protect watershed resources from human development activities that result in deforestation, overgrazing, soil erosion, salinization, soil degradation, and desertification
- Subdivide each rural watershed into various land-use areas with guidelines and restrictions
  - Agricultural
  - Rangeland or grassland
  - Forestland
  - Riparian area
  - Wildlife and national parks

Rural Development Authority Branches

Multi-Sector small and medium business development

- Consumers must have the income to purchase locally
- Incomes are dependent on employment;
  - Foster business development in rural communities concurrently with the implementation of MAPT to create new employment opportunities for farm owners and workers potentially unemployed by increased farm production and associated declining crop prices
- Establish accessible offices in rural communities to provide locals with business development, management, expansion, marketing support, and advice services
- Provide rural communities with access to financial credit

Rural Development Authority Branches

Infrastructure Development

- Roads
- Electrification
- Communication
- Crop storage
- Social and policy advancement
- Dependency on donor nations

Rural Development Authority Branches
Infrastructure Development

- Roads
  - Easier transport of products, supplies, and people
  - Facilitates trade between nearby regions
    - Helps lower transportation and imported agriculture input costs

Source: Trek Earth (2004). Road in Guinea, West Africa.

Rural Development Authority Branches
Infrastructure Development

- Electrification
  - Small and medium businesses require some form of consistent power
  - Focus on renewable sources of energy

Source: Alliance Earth (2015). Cookhouse Wind Farm in Eastern Cape of Africa.

Rural Development Authority Branches
Infrastructure Development

- Communication
  - Necessary for sharing new ideas, techniques, and technologies
  - Access to weather patterns and market conditions

Source: My Broadband (2016). Cell tower in SSA.

Rural Development Authority Branches
Infrastructure Development

- Crop Storage
  - Store surplus
  - More storage will provide stronger incentive to increase crop production

Source: SUPPLIED (2013). Grain Silo in SSA.

Rural Development Authority Branches
Infrastructure Development

- Social and Policy Advancement
  - Strengthen sovereignty through greater social and political stability
- Population Stabilization
  - Primary mission of the Social and Policy advancement department

Rural Development Authority Branches
Infrastructure Development

- Dependency on donor nations
  - Must follow the natural progression of economic development over time
  - Transition from subsistence farming to surplus production
  - Support must be education on how to be self-sufficient
  - Chronic aid weakens the resolve and authority of government's leadership

Conclusions

- SSA is the least developed major region in the world and its population is increasing at a dangerously high rate
- Minimize or eliminate extreme poverty, hunger, and malnutrition
- Address rapid population growth and degradation of natural resources
- Apply RRCP, HRRCP, MHCP, FDW, MHAP
- Surplus agricultural production
- LTSAP and DSED
- Achieve sustainable food security
  - Set Up RDA
    - Agricultural development, multi-sector small & medium business development, natural resources development, knowledge enhancement, infrastructure development, and social & policy advancement
- Ascend to light industrialization

Thank you

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