
SONS AND DAUGHTERS
OF THE SOIL

When a newborn baby opens his or her eyes to check out the new environment...

he/she will discover that this world is covered with brown sandy, muddy, or rocky stuff with green things growing out of it.

That little one can not know that his or her growth, health, intellectual development, and even chance of survival may depend more upon the quality of that brown substance than on any other factor.

Whether that soil is rich or poor in micronutrients determine whether plants and the animals (including humans) that consume them grow well, are hearty, and survive diseases.

WHAT ARE MICRONUTRIENTS?

- Essential micronutrients include vitamins and minerals that occur in in small or trace amounts in the diet and are essential for life.

Only recently are we coming to understand how micronutrients in the soil impacts the quantity and nutritional quality of the foods that it produces.

There are many pressures on soil. It can be accidentally contaminated with toxins or radiation, carelessly eroded, leached, chemically over treated, or deforested.

EROSION

LEACHING

DEFORESTATION

When the soil of a region is depleted of specific nutrients, plant, animal and human nutritional deficiency states can often be found in those places. The consequences can be devastating and deadly.

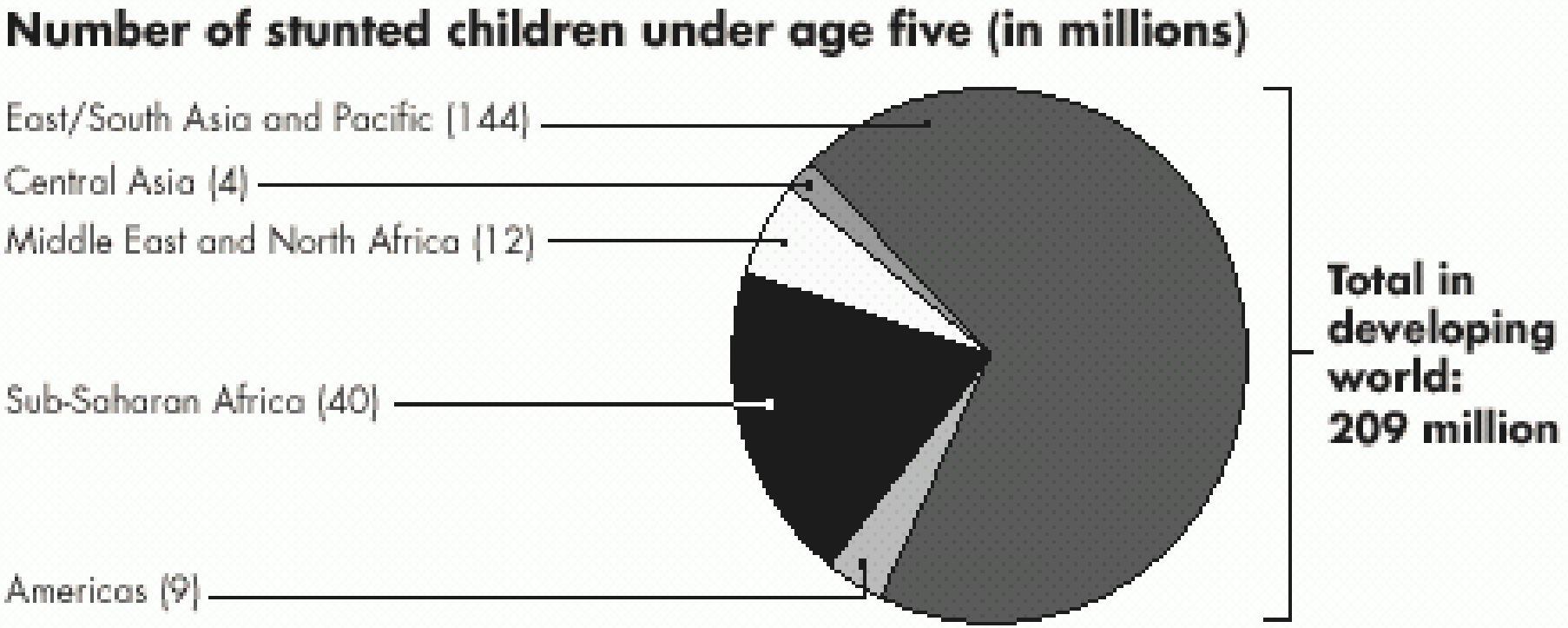
Sometimes, scientific information on micronutrients in soils, crop and farm animals sheds light on the role of micronutrients in human health and especially child survival.

Many micronutrients are required for child survival. One of the best predictors of survival is that a child is growing well. Growth stunting in children is an ominous warning of risk of death, especially from infection.

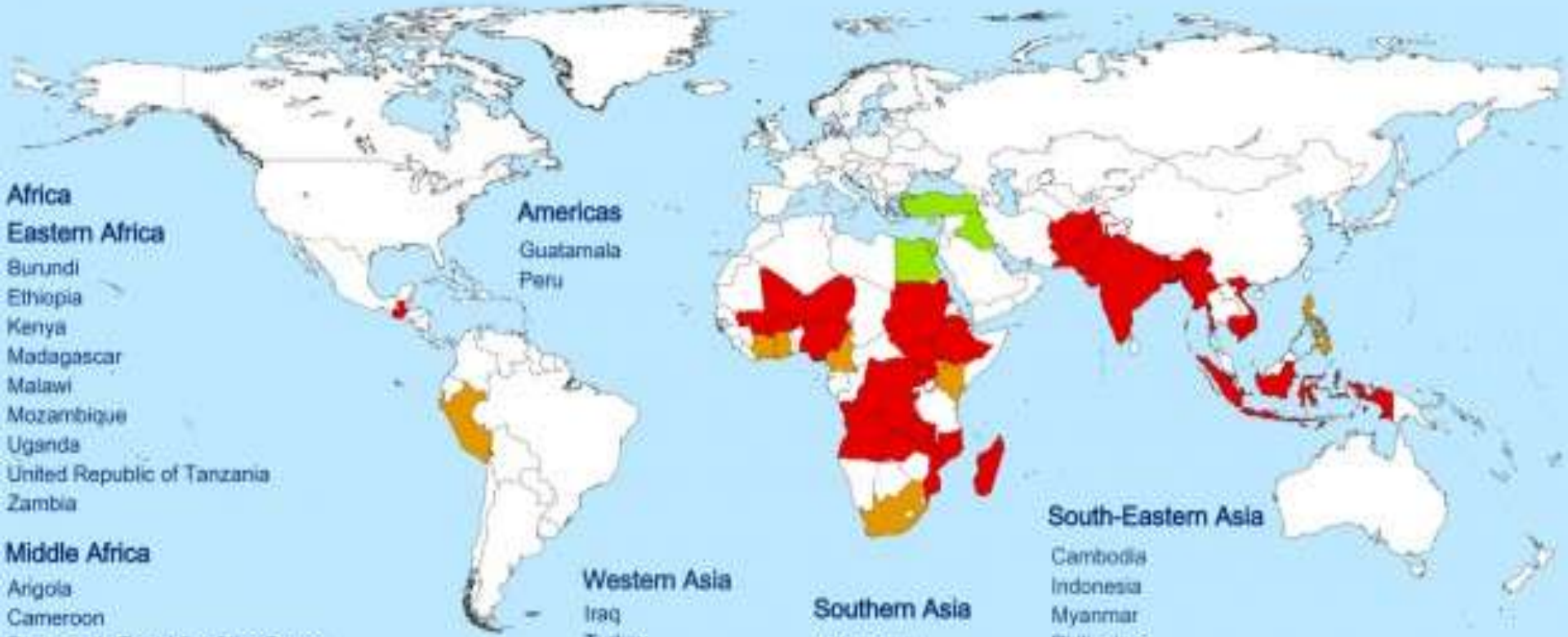
WHAT STUNTING LOOKS LIKE

- Nearly 40% of all children < five in the world are stunted due to micronutrient deficiency.
- Many of them will also face challenges in school as a result.
- Here, a contrast in stature is apparent between two girls the same age in Bangladesh.

STUNTING AROUND THE WORLD



Stunting - 36 high-burden countries

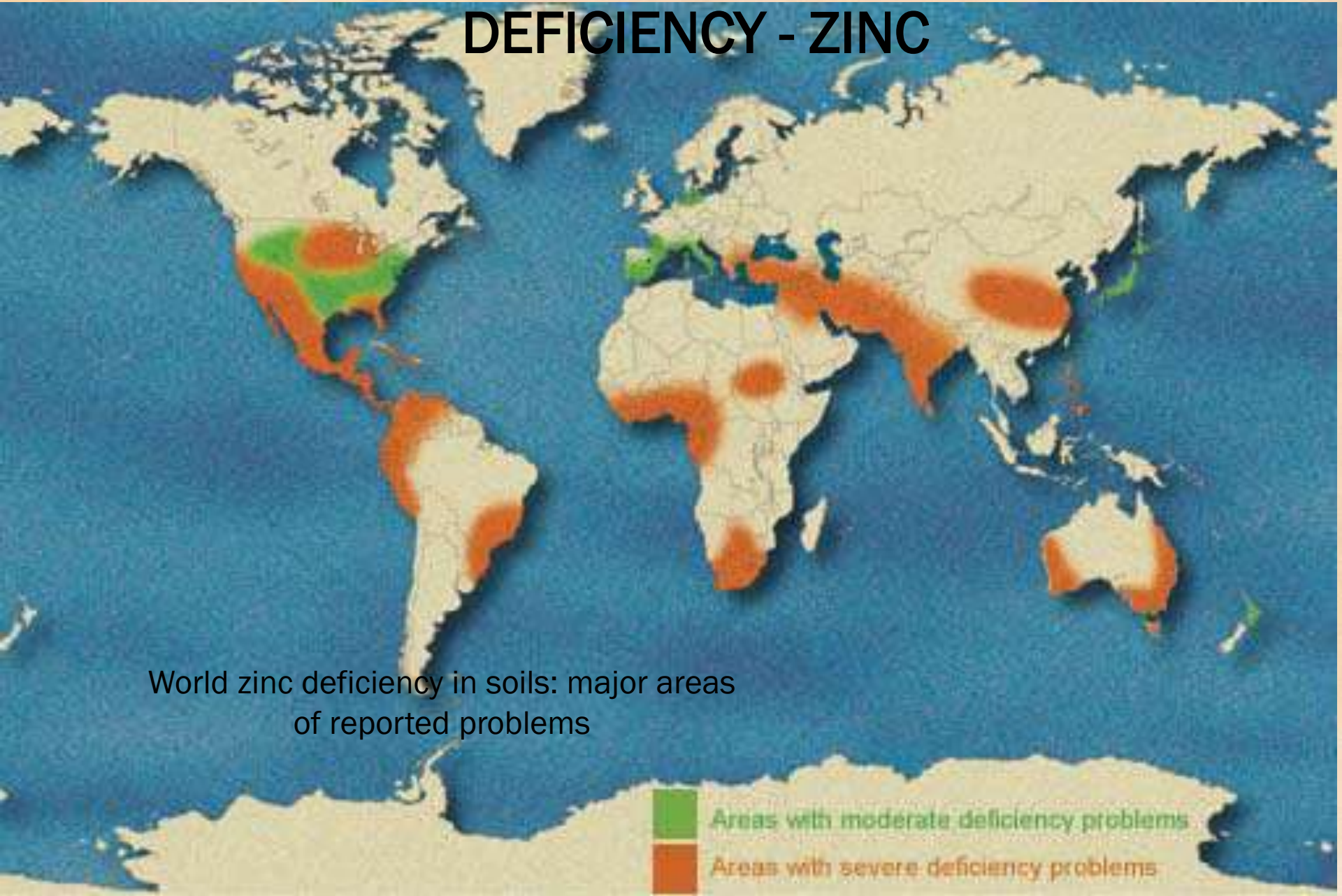


HUMAN MICRONUTRIENT DEFICIENCY

ZINC

- Breakthrough hypothesis in 1961 labeled zinc as a major contributing factor in the syndrome of "**adolescent nutritional dwarfism**" or growth stunting

MOST WIDE SPREAD SOIL MICRONUTRIENT DEFICIENCY - ZINC



World zinc deficiency in soils: major areas of reported problems

ZINC DEFICIENCY IN SOIL EXAMPLES:

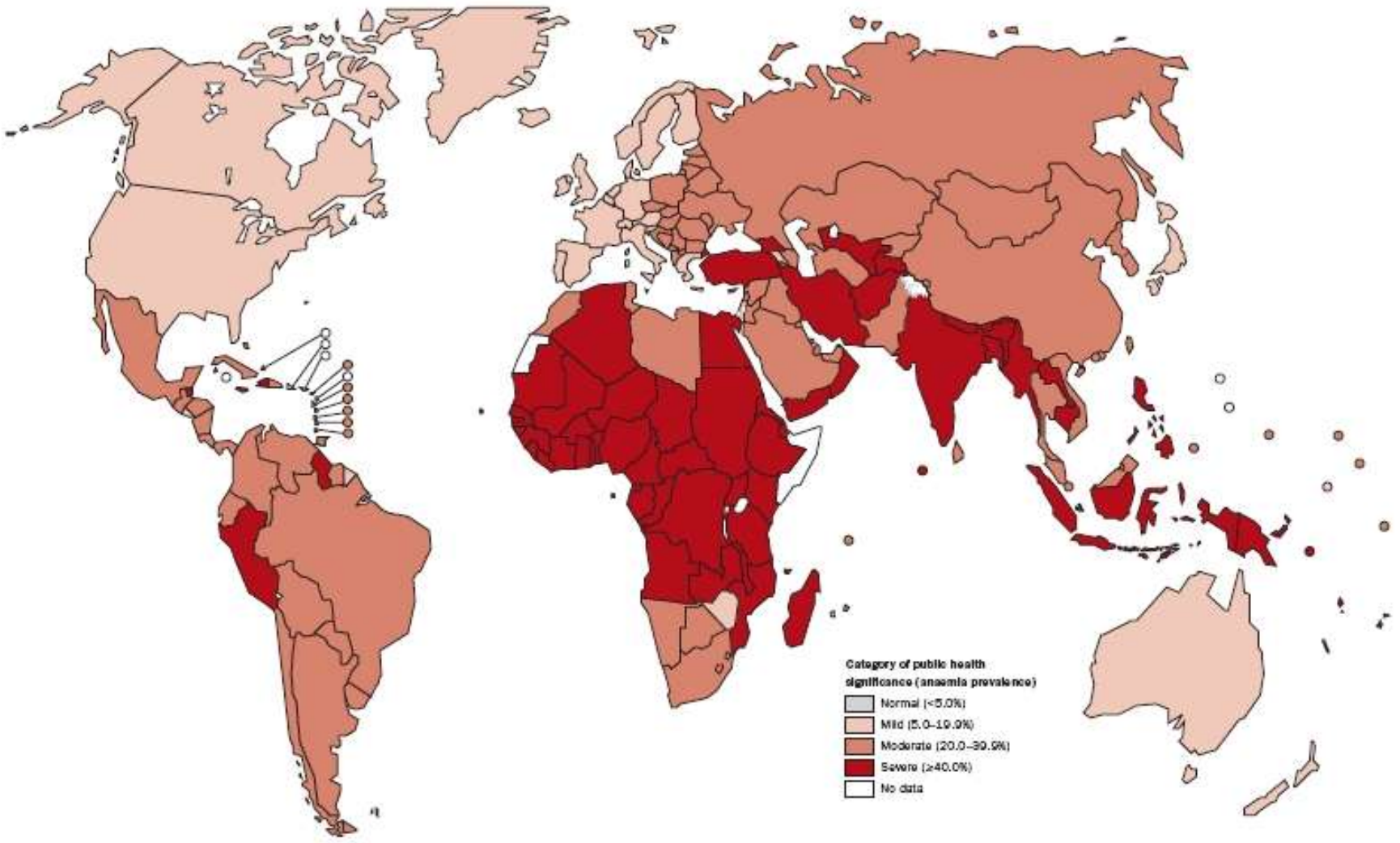
- 1/2 of agricultural soils in India
- 1/3 of agricultural soils in China
- 50% of cultivated land in Turkey

CONSEQUENCES OF ZINC DEFICIENCY IN SOIL

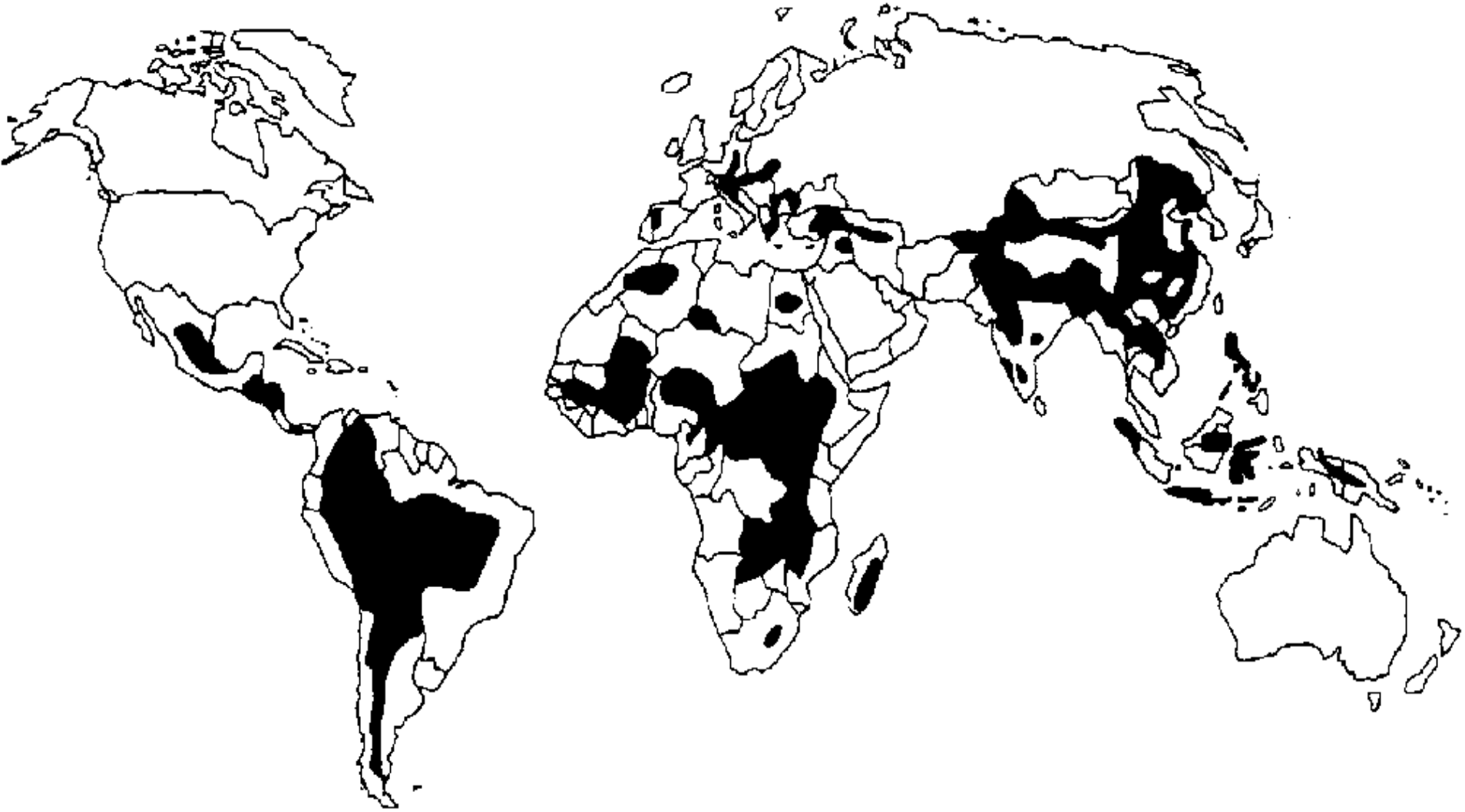
Plant	Animal	Human
-Stunting -Tissue becomes translucent -Crinkled leaves	**-Stunting** -Hair loss -Skin lesions -Testicular atrophy -Birth complications	**-Stunting** -Increased infections -Impaired cognitive function -Testicular atrophy -Decreased child survival

WORLDWIDE IRON DEFICIENCY MAP

Figure 3.1b Anaemia as a public health problem by country: Pregnant women



WORLDWIDE IODINE DEFICIENCY MAP



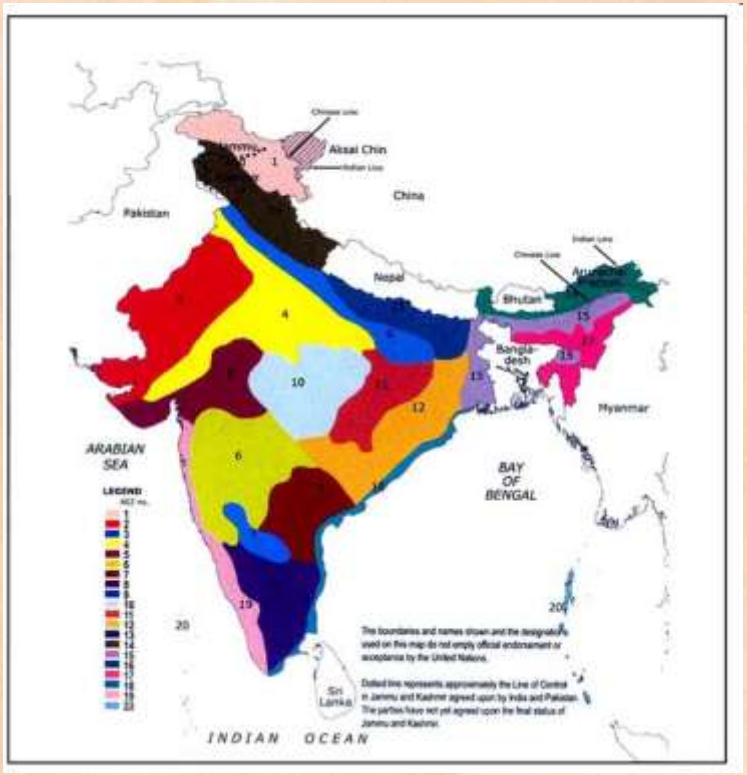
Areas with known iodine deficiency

Some unshaded areas may represent countries where surveys on IDD have not been conducted

SOME COUNTRIES, LIKE INDIA, HAVE DETAILED INFORMATION ON THEIR SOILS:

- 49% deficient in Zinc
- 4% deficient in Manganese
- 3% deficient in Copper
- 33% deficient Boron

Agro-ecological zones of India



GLOBAL BURDEN OF DISEASES DUE TO MICRONUTRIENT DEFICIENCIES

- 2 billion people in the world are deficient in iron causing anemia, a major cause of death in women
- 750 million people globally suffer from iodine deficiency-the biggest cause of mental retardation worldwide
- 250 million children in the world are estimated to be deficient in Vitamin putting them at risk for death from infections, and causing 500,000 annual cases of blindness in childhood
- 56% of deaths among children under age 5 in 53 developing countries were related to micronutrients deficiencies

ADVERSE AFFECTS OF MICRONUTRIENT DEFICIENCES IN HUMANS

<u>According to the CDC:</u>

1. Child survival and growth
2. Women's health and pregnancy outcome
3. Brain development and I.Q. of populations
4. Educational achievement
5. Adult productivity
6. Resistance to illness

CONSEQUENCES OF MICRONUTRIENT DEFICIENCIES

	Immune Deficiency — More vulnerable to illness and death from serious infections – pneumonia, diarrhea, malaria, measles, TB, HIV "Nutritional AIDS"	Nutritional Anemia	Mental /Neurological Disease or Delay	Bleeding	Growth Stunting — Slow healing and poor issue	Nutritional Blindness	Noma — Oral tissues, immunity	Birth Defects	Beriberi	Pellagra	Bone weakness — Ricketts /Osteoporosis	Thyroid disease — Hypothyroidism/Goiter	Scurvy
A: Retinol	♦	♦			♦	♦	♦	♦					
B1: Thiamin		♦					♦	♦	♦				
B2: Riboflavin	♦	♦			♦		♦	♦		♦			
B3: Niacin	♦	♦	♦				♦	♦		♦			
B5: Pantothenic Acid		♦	♦										
B6: Pyridoxine		♦						♦		♦			
B9: Folic Acid	♦	♦					♦	♦					
B12: Cyanocobalamin		♦	♦	♦	♦		♦	♦					
C: Ascorbic Acid	♦			♦	♦		♦	♦					♦
D3: Calciferol	♦			♦	♦		♦				♦		
E: Tocopherol	♦	♦	♦		♦								
H: Biotin								♦					
K: Phylloquinone				♦	♦		♦				♦		
Iron	♦	♦	♦					♦		♦			
Iodine			♦		♦			♦				♦	
Selenium	♦	♦			♦		♦					♦	
Copper		♦						♦		♦	♦	♦	
Zinc	♦	♦	♦		♦	♦	♦						

Diseases caused by deficiency of more than one micronutrient are best prevented/treated by replenishing all necessary nutrients

The first 1,000 days of a child's life from conception to age 24 months are critical in determining a child's survival and future health and intellectual development.

We will look at a few examples of diseases related to specific micronutrient deficiencies.

VITAMIN DEFICIENCIES:

Vitamin D

- Rickets

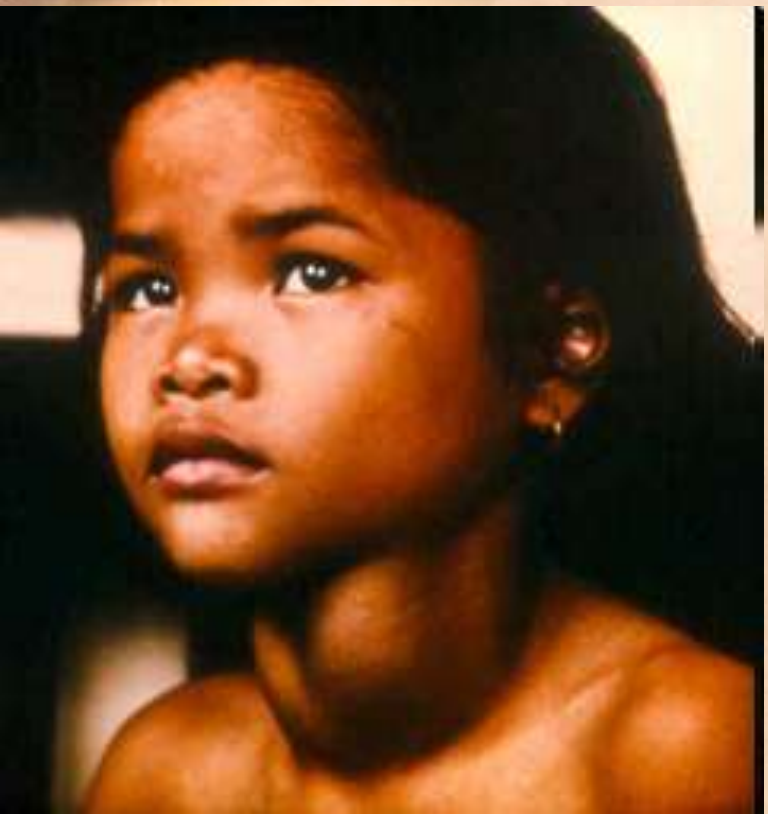
Vitamin A deficiency Nutritional Blindness

NUTRITIONAL ANEMIA

- Iron deficient children show symptoms with pale skin.
- Micronutrient nutrition is also critically important for women of child bearing age, as nutritional anemia is a significant contributor to maternal mortality.

IODINE DEFICIENCY

Goiter



Cretinism

CONSEQUENCES OF MICRONUTRIENT DEFICIENCIES

Nutritional AIDS

- Inability to fight off infections
- Diseases like Noma occur in places where the soil, plants, animals and children are micronutrient deficient

CONSEQUENCES OF MICRONUTRIENT DEFICIENCIES

Children are more vulnerable to death from infectious diseases such as;

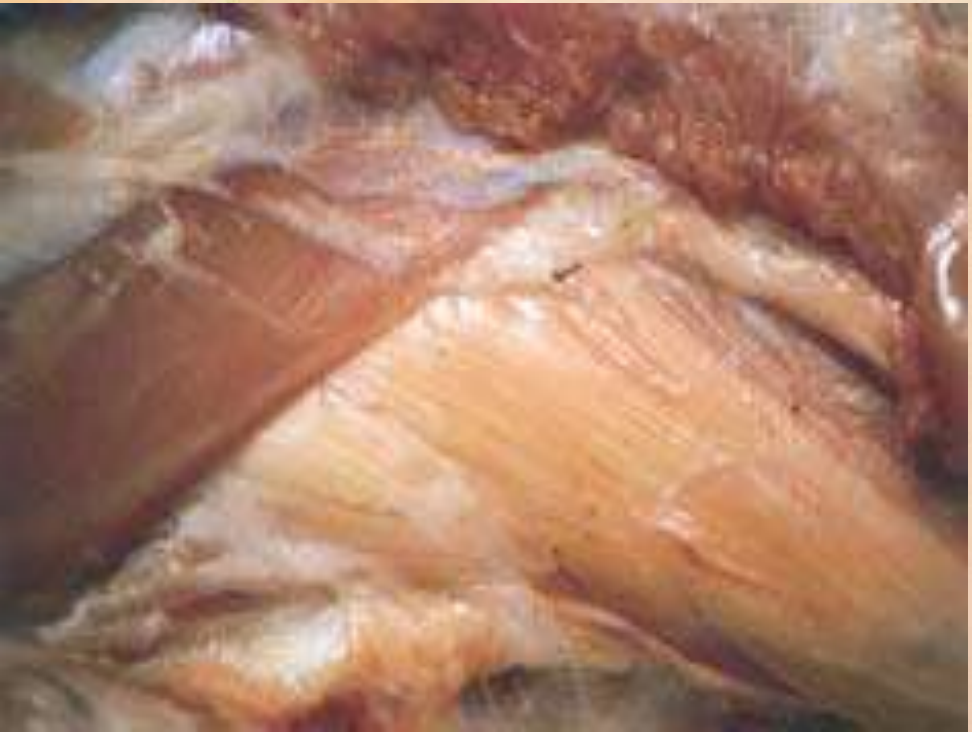
- Malaria
- Pneumonia
- Diarrhea

WHAT DOES SELENIUM DEFICIENCY LOOK LIKE?

White Muscle Disease

- Animal muscular dystrophy

Leg muscles of WMD affected lamb: note the normal dark red muscle and the affected pale white muscle.



Kashin-Beck Disease

- Growth of joint Cartilage

Man showing symptoms of joint destruction/enlargement: resulting in restricted movement.

FACTORS THAT CONTRIBUTE TO MICRONUTRIENT DEPLETION

Immediate Causes

- Inadequate intake of vitamins and minerals
- Diseases that cause the loss of, or the need for more vitamins and minerals

Underlying Causes

- **Low content or density of vitamins and minerals in food**
- Inadequate care of mothers and children
- Lack of access to adequate health services, clean water, and good sanitation

FACTORS CONTRIBUTING TO POOR MICRONUTRIENT AVAILIBILITY IN FOOD SOURCES

- Inadequate income to purchase variety/sufficient amount of foods
- Poor quality of a habitual diet and lack of dietary diversity
- Poor access and availability to fertile land
- **Micronutrient availability in soils on which the foods are grown**

- People who are dependent upon food that is micronutrient deficient because it was grown in micronutrient depleted soils are at risk for micronutrient deficiency, and the disease states associated with those micronutrient deficiencies.

  - EX. Populations living in iodine deficient regions historically have had a high incidence of iodine deficient goiter, and mental and physical growth retardation known as cretinism. With iodination of salt, this problem is eliminated.
  - EX. In a belt running through large regions of China, Selenium deficiency was found to be causing severe orthopedic deformities (Kashin-Beck disease), cardiac failure, especially in women and children (Keshan disease) and white muscle disease in livestock. Selenium supplementation has controlled this problem.

COMBATING MICRONUTRIENT DEFICIENCIES

1. **Public health approaches**
- Education, disease control, socioeconomic, and environmental aspects
2. **Food-based strategies**
- *Dietary approaches*-promotion of breastfeeding and adequate complimentary feeding
- *Supplementation*-chosen when nutrient intake is difficult to achieve through diet
- *Fortification*-inexpensive, adds vitamins/minerals to food/condiments regularly consumed

Climate and soil conditions impose a ceiling on the health the community can achieve. Plants and animals trying to survive in a depleted environment face a enemy that cannot be underestimated- micronutrient poor soil.

Successful fortification and distribution:

- Vitamins A&D in milk
- Iodine in salt
- Iron in flour
- Fluoride in water
- Vitamin A in sugar
- Vitamin A capsules
- Folic acid and iron tablets
- Iodine enriched oil administration
- Vitamin D capsules
- Cod liver oil
- Zinc tablets for diarrhea
- Multivitamins

There is still a large population that does not consume processed or fortified foods and is not reached by these successful interventions.

HOME FOOD FORTIFICATION with Multiple Micronutrient Powder

Can assure the most vulnerable children and adults (especially childbearing women) receive the benefit of micronutrients to prevent death and disease

Micronutrient powder has attracted growing interest because it is:

- Inexpensive
- Low-tech
- Able to address multiple deficiencies that are prevalent in developing countries, especially where soils are most depleted

WHAT OTHERS ARE SAYING…

"Because malnutrition affects health, education, employment and life's other essentials, it is everybody's problem. Unfortunately, in too many countries this means that it ends up being nobody's problem, so no one takes the lead to fix it. "

–Bread For the World 2006 Hunger Report

WHAT OTHERS ARE SAYING…

Many families simply cannot afford to provide nutritious food—particularly animal source foods such as milk, meat, and eggs—that their young children need to grow and thrive. Instead, they struggle to survive—far from the media spotlight—on a diet of little more than cereal porridges of maize or rice, amounting to the equivalent of bread and water.

-Doctors without Borders

WHAT OTHERS ARE SAYING…

"Fortifying foods with basic vitamins and minerals is both essential and affordable."

-Bill Gates, co-founder, Bill and Melinda Gates Foundation

WHAT OTHERS ARE SAYING…

"We now have the knowledge and the solutions that can protect the muscles, brains and blood of whole populations at an extraordinarily low cost."

-Venkatesh Mannar, President, The Micronutrient Initiative

WHAT OTHERS ARE SAYING…

"The road to regional health and life-long productivity cannot be passed without removing the obstacle of vitamin and mineral deficiency."

-Joseph Hunt, Health and Nutrition Adviser, Asian Development Bank

Why not allow ALL children born at this time in human history to have a share in the heritage of living-saving scientific advances that have eliminated childhood disease and death from micronutrient malnutrition in many regions of the world?

Why not allow help and hope to come to ALL children, even those, who by the accident of their birth, are “Sons and Daughters of the Soil” that has been ravaged and wasted?

They are not doomed, unless their needs are ignored, and those who could bring help chose not to!

It takes a village to save a *vulnerable* child:

- Governments need POLITICAL WILL
- Religious leaders and non-profits need MORAL CONVICTION
- Food producers need TECHNICAL SUPPORT
- Mothers need POWER AND OPPORTUNITY to nourish their children with micronutrient-rich food whether they grow it, buy it or enrich it with micronutrients in their own kitchens