

# The Future of Science: Agriculture, Food, Nutrition

**Barbara Burlingame, PhD**



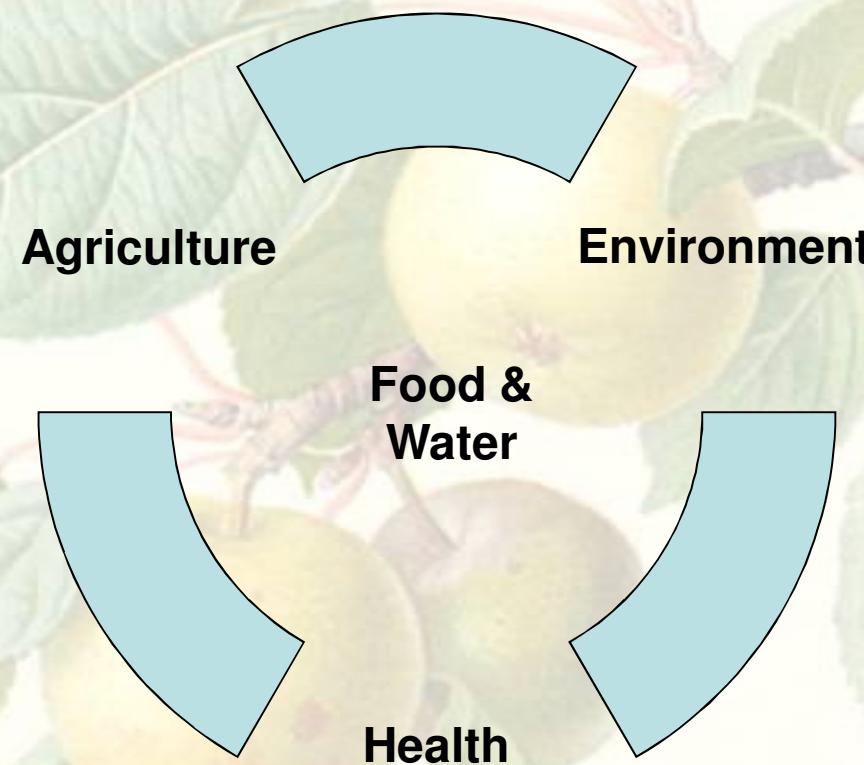
# Issues

- Millennium Development Goals
- Food energy and bio-energy
- Soaring food prices
- Climate change
- Biodiversity and biotechnology
- Food quality
- Food safety

Successes, failures and a legacy of unintended consequences



# Interdependencies

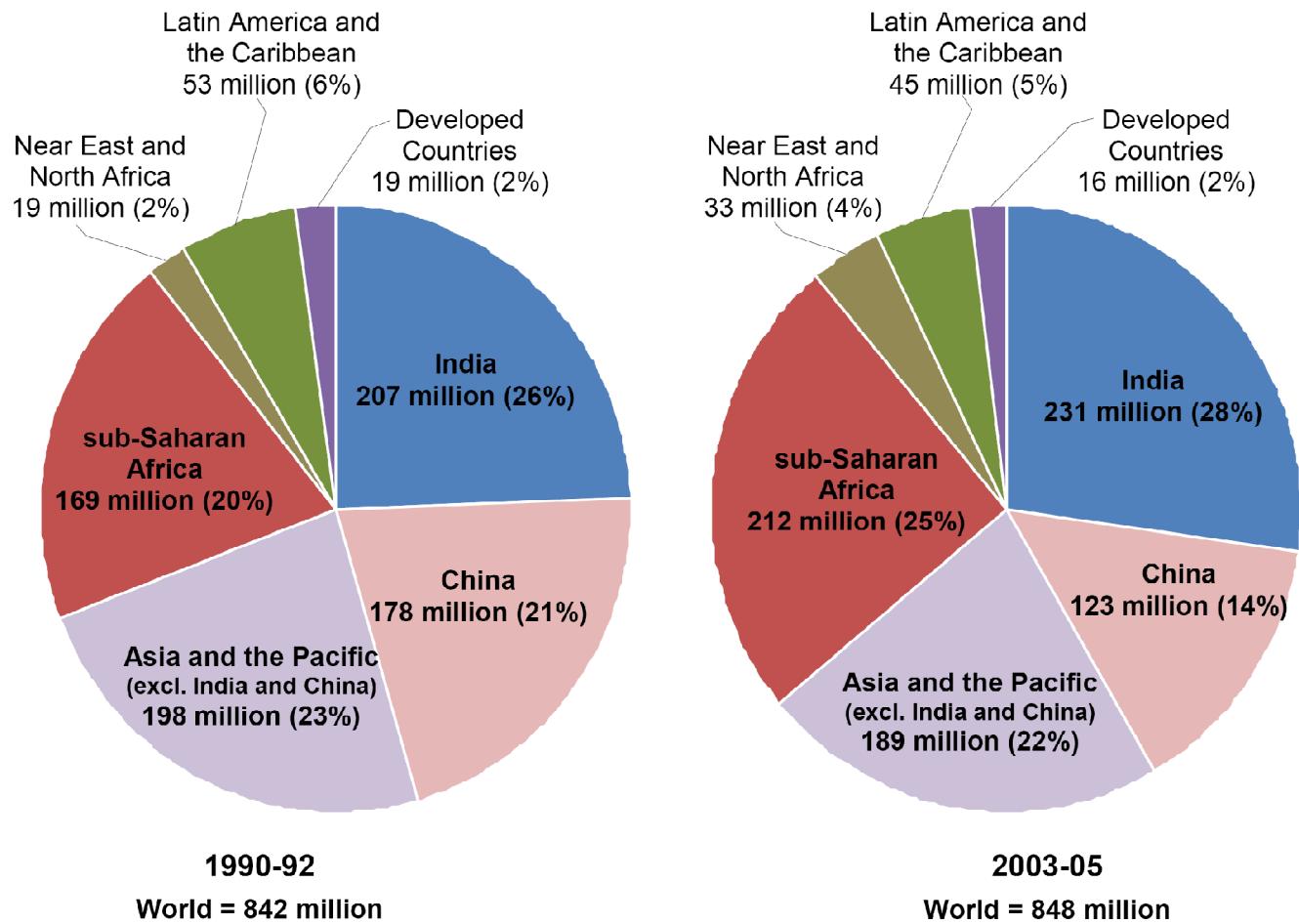


Goal 1, target 2: Halve the proportion of people who suffer from hunger (by 2015);

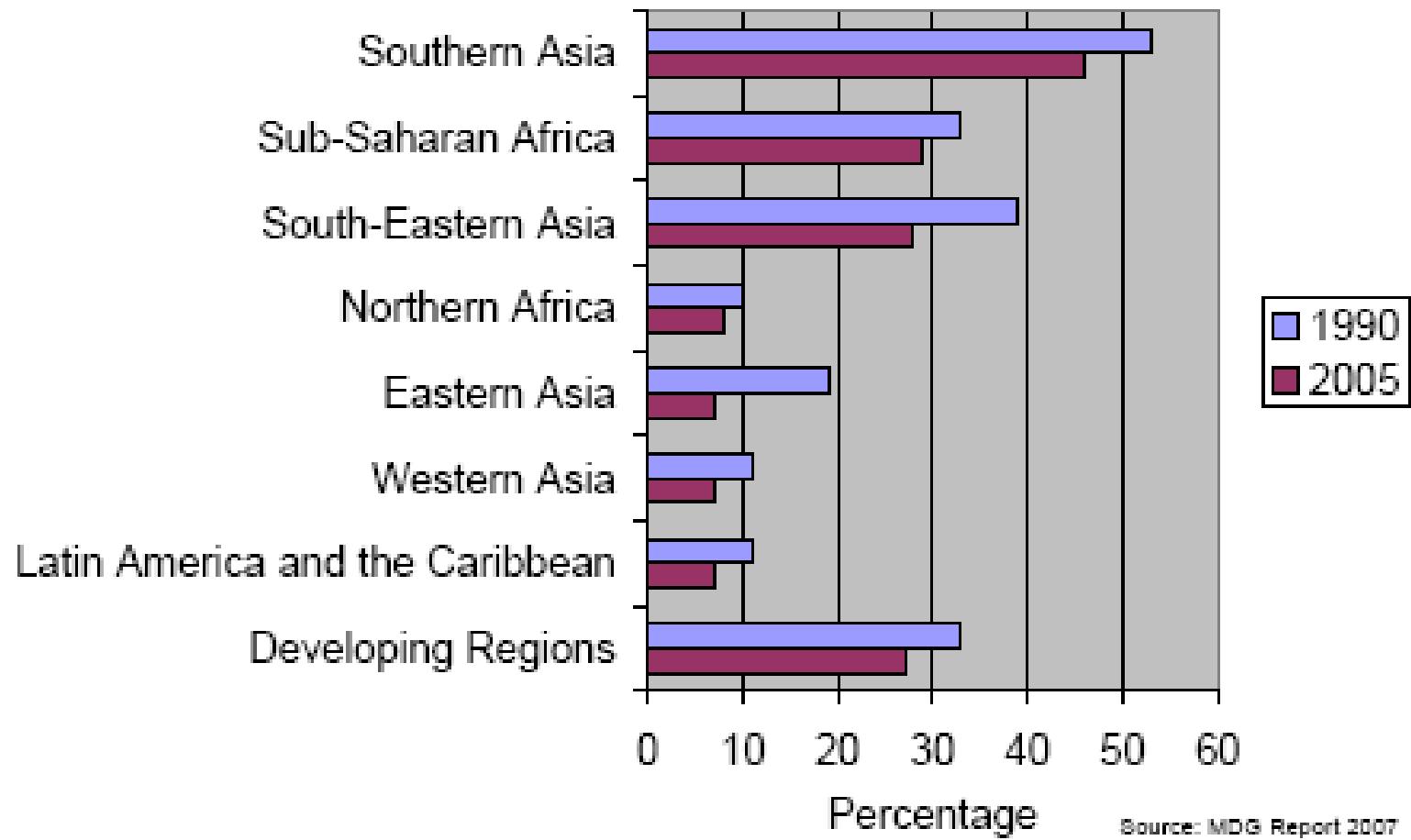
Goal 7: Ensure environmental sustainability, integrating principles of sustainable development into national policies and programmes and reverse the loss of environmental resources



# Trends in global undernourishment (DES)



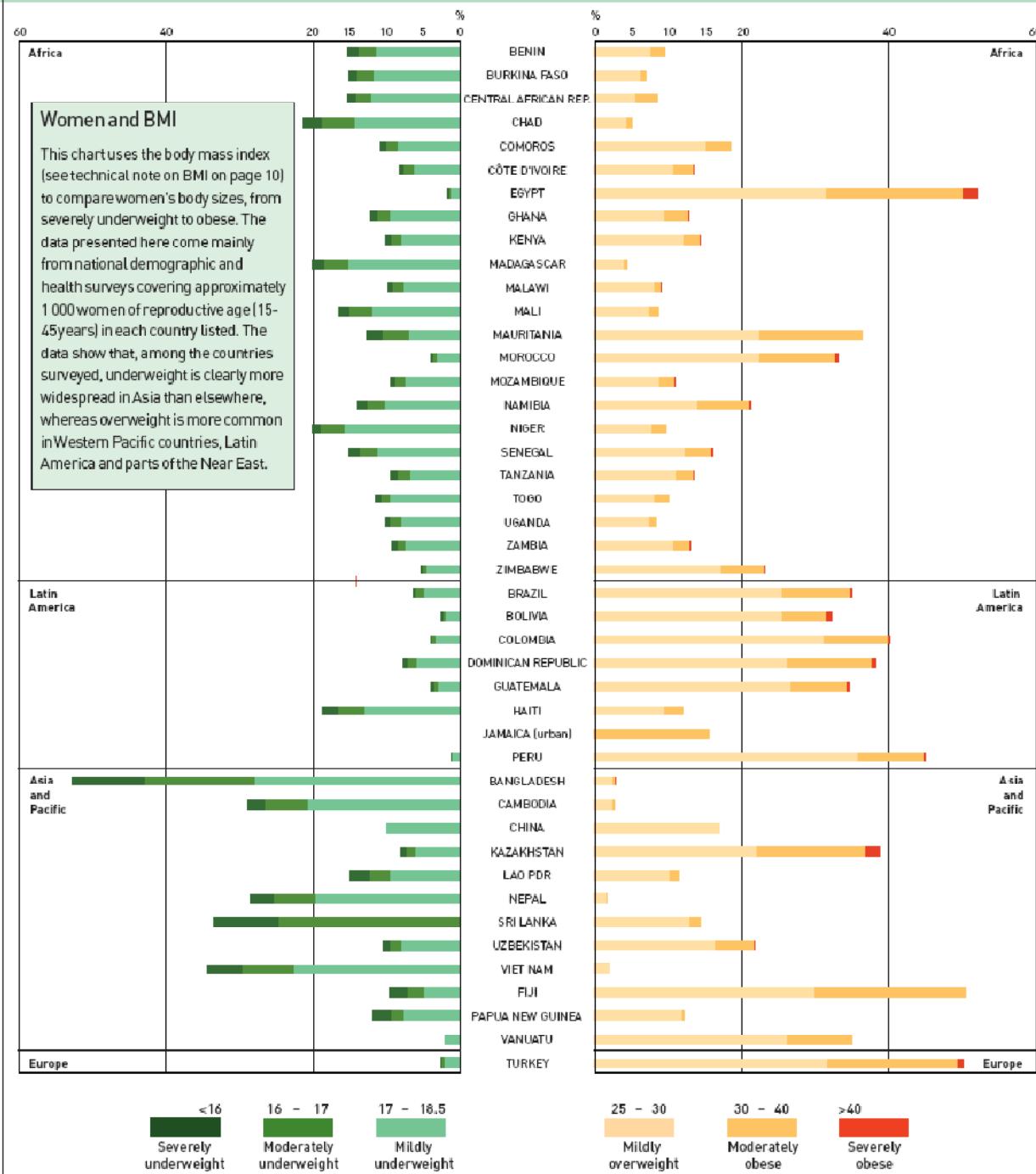
# Prevalence of underweight (<5 yr)



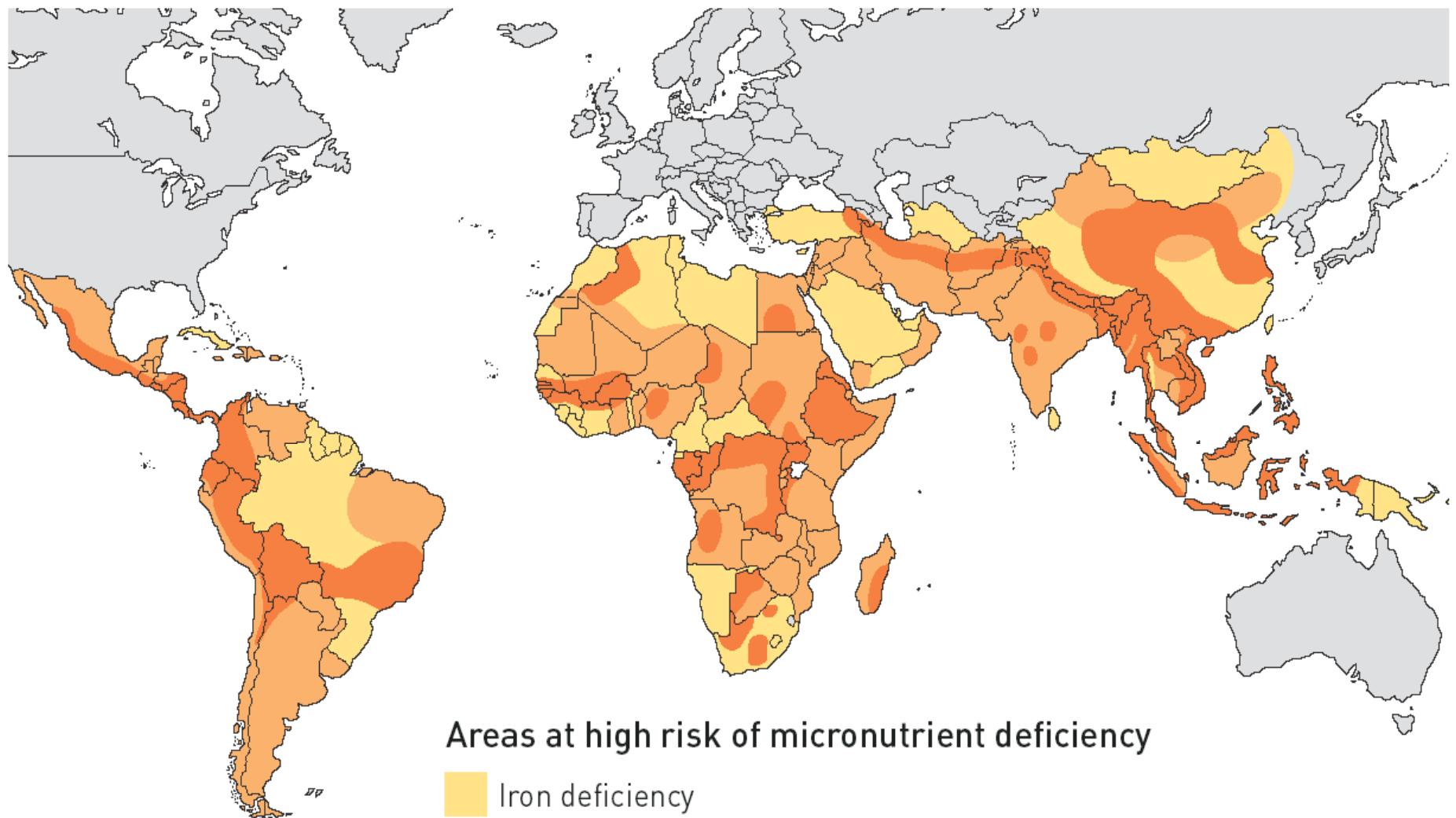
Source: MDG Report 2007



## Percentage of women outside healthy range of body mass index



# Prevalence of micronutrient deficiencies in developing countries



Areas at high risk of micronutrient deficiency

- Iron deficiency
- Vitamin A and iron deficiency
- Iodine, vitamin A and iron deficiency

Source: USAID

# Livestock: protein and iron nutrition



The in-depth assessment of the significant impacts of the world's livestock sector on the environment...the substantial contribution of animal agriculture to climate change & air pollution; to land, soil and water degradation; and to the reduction of biodiversity.



Goal 1, target 2: Halve the proportion of people who suffer from hunger (by 2015);

Goal 7: Ensure environmental sustainability, integrating principles of sustainable development into national policies and programmes and reverse the loss of environmental resources



# Intergovernmental Working Group on Plant Genetic Resources

Provide guidance on how to best support countries, on request, to generate, compile and disseminate cultivar-specific nutrient composition data\*, as well as indicate the relative priority of obtaining cultivar-specific dietary consumption data, in order to demonstrate the role of biodiversity in nutrition and food security.

\*Includes conventional nutrients, bioactive non-nutrients (phytochemicals, antioxidants, etc.), and contaminants



# Conference of the Parties

Decision VII/32 (Kuala Lumpur, Malaysia, February 2004)

**Noting** the linkage between biodiversity, food and nutrition...

**Requests**...FAO and IPGRI...to undertake...a **cross-cutting initiative on biodiversity for food and nutrition** to work together with relevant organizations, in order to strengthen existing initiatives on food and nutrition, enhance synergies and fully integrate biodiversity concerns into their work, with a view to the achievement of...relevant Millennium Development Goals.

Decision VIII/23A (Curitiba, Brazil, March 2006)

**Adopts** the framework for a cross-cutting initiative on biodiversity for food and nutrition.



# Cross-cutting initiative on nutrition and biodiversity

## ***The mandate***

FAO is leading, in collaboration with Bioversity International, the Cross-cutting initiative biodiversity for food and nutrition

## ***Ways and means***

- Develop the evidence base for the initiative...
  - Compiling, reviewing and analyzing existing scientific information, indigenous and traditional knowledge
- Support countries in generating, compiling and disseminating new cultivar-specific nutrient-composition...
- Strengthen local infrastructure and human resources for the generation of such data...
- Support development of the indicator(s)...
- Communications, advocacy, policy...

[http://www.fao.org/infoods/biodiversity/index\\_en.stm](http://www.fao.org/infoods/biodiversity/index_en.stm)



# Sweet potato varieties: α - and β-carotene, mg/100g fresh wt

Variety	%Moisture	β-carotene	α-carotene
<i>Orange Flesh</i>			
Excel	77.8 (0.8)	12.8 (0.1)	< 0.1
Kona B #	77.8 (0.6)	6.7 (0.2)	1.5 (0.2)
Regal	77.2 (2.1)	13.1 (0.7)	< 0.1
UH 71-5 #	70.3 (1.1)	8.0 (0.1)	< 0.1
<i>Yellow/White Flesh</i>			
Hoolehua Red #	70.4 (2.7)	0.2 (0.1)	< 0.1
Satsuma #	68.3 (0.2)	0.6 (0.1)	< 0.1

n=6, values in parentheses are standard errors. # Varieties are recommended by the University of Hawaii Extension Service for good yield and disease resistance. Source: A. S. Huang, L. Tanudjaja, D. Lum. Journal of Food Composition and Analysis, Vol. 12, No. 2, Jun 1999, pp. 147-151.



# Food Composition Data and Health Messages

# **POHNPEI BANANAS (UHT KAN EN POHNPEI): CAROTENOID-RICH VARIETIES**



**Grow and eat orange- and yellow-fleshed varieties for your health to help protect against diabetes, heart disease, certain cancers, vitamin A deficiency, and anemia.**

**Padok oh sakan soangen uht kan me oangoahng pwehn sewese omwi roson: souwmuhua en suke, souwmuhua en mohngiong, cancers, seuitar en vitamin A, oh seuitar en nta.**

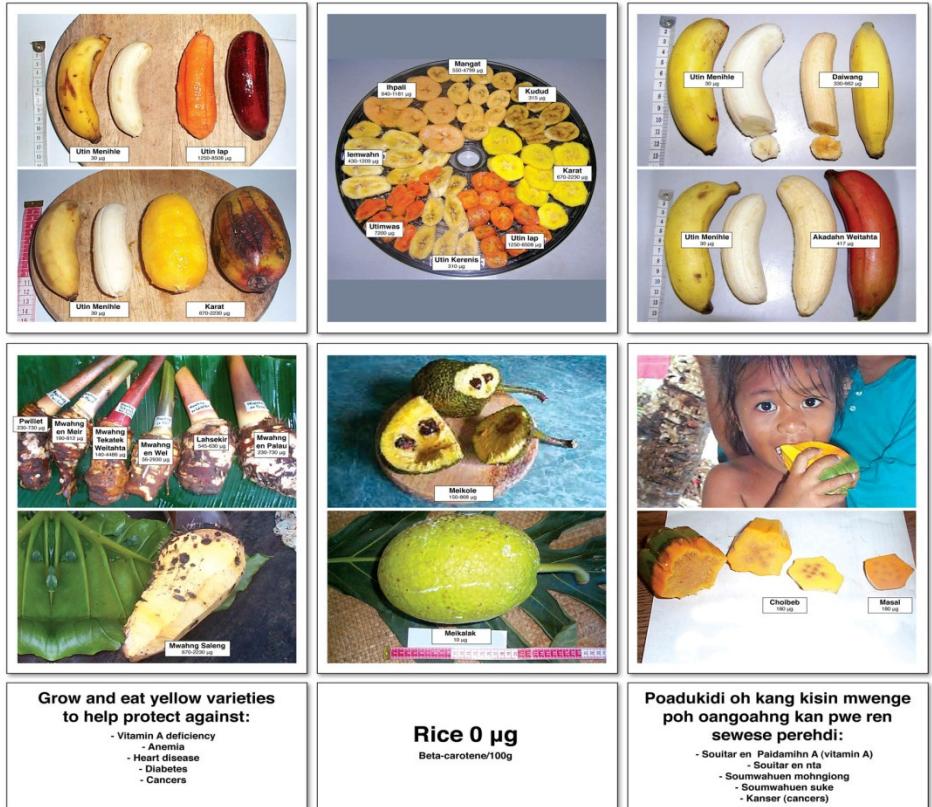
A grant of the Island Fund Community of Political Funding supports the Center for Disease Control and Prevention (CDC) Program for the Protection of Children's Health (PPCH), Sights and Life, Australian Institute of Family Health, and the National Institute of Environmental Health Sciences (NIEHS) Program (SIGHTS: Positive Developments and Philosophies that Encourage the Use by Parents of Safe Products for Their Children). The PPCH is a program of the University of Minnesota/Twin Cities. Adjunct faculty include: Michael Ballew, Philip J. Gitterman, and Lynn Leiberman. The SIGHTS program is directed by Dr. Linda C. Johnson, and the NIEHS Program is directed by Dr. James P. Kauh. The University of Minnesota is a member of the University of Minnesota Research Foundation, Inc., which is a non-profit organization that receives funds from the University of Minnesota, the University of Minnesota Foundation, and the University of Minnesota Academic, Research, and Creative Activity Council. Research Council of Minnesota, St. Paul, MN.

Note:  $\mu\text{g}$  (microgram) is a weight unit (one millionth of a gram). After beta-carotene is consumed, it may be changed into vitamin A (VA) in the body. Of all provitamin A carotenoids, beta-carotene

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# Kisin mwengehn Pohnpei kan me kolokol “Vitamin A” laud

## Pohnpei Carotenoid-Rich Foods



**Grow and eat yellow varieties  
to help protect against:**

- Vitamin A deficiency
    - Anemia
    - Heart disease
    - Diabetes
    - Cancers

**Rice 0 µg**  
Beta-carotene/100g

Poadukidi oh kang kisin mwenge  
poh oangoahng kan pwe ren  
sewese perehdi:

- Souitar en Paimamih A (vitamin A)
    - Souitar en nta
  - Soumwahuen mohnglong
    - Soumwahuen suke
    - Kanser (cancers)

A project of the Island Food Community of Pohnpei (IFCP).  
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Note:  $\mu\text{g}$  (microgram) is a weight unit (one millionth of a gram). After beta-carotene is consumed, it may be changed into vitamin A (VA) in the body. Of all provitamin A carotenoids, beta-carotene contributes the most to VA status. Beta-carotene and other carotenoids are found in ripe fruits. That is why there is beta-carotene content of samples of giant swamp turnip and ripe banana, breadfruit, and pandanus. Samples were analyzed as raw or cooked samples, according to use.

# Traditional use and availability of aquatic biodiversity in rice-based ecosystems

	Cambodia	China	Laos
Fish	70	52	27
Crustaceans	6	2	5
Molluscs	1	4	8
Amphibians	2	4	10
Insects	2	3	16
Reptiles	8	-	7
Aquatic Plants	13	19	20
<b>Total</b>	<b>102</b>	<b>84</b>	<b>93</b>

Source: Balzer, Balzer, Pon, 2002; Luo, in press; Xaypladeth, in press

# International Rice Commission

## Recommendations:

- Existing biodiversity of rice varieties and their nutritional composition need to be explored before engaging in transgenics;
- Nutrient content needs to be among the criteria in cultivar promotion;
- Cultivar-specific nutrient analysis and data dissemination should be systematically undertaken;
- Biodiversity questions and/or prompts should be included in food consumption surveys;
- Acquiring nutrient data and intake data for varieties is essential in order to understand the impact of biodiversity on food security.

FAO (2002). Report of the International Rice Commission  
20th Session (23-26 July 2002, Bangkok). FAO, Rome.



# International Rice Commission

## Recommendations:

Member countries should promote the sustainable development of aquatic biodiversity in rice-based ecosystems and policy decisions and management measures should enhance the living aquatic resource base.

In areas where wild fish are depleted, rice-fish farming should be considered as a means of enhancing food security and securing sustainable rural development.

Attention should be given to the nutritional contribution of aquatic organisms in the diet of rural people who produce or depend on rice.

FAO (2002). Report of the International Rice Commission  
20th Session (23-26 July 2002, Bangkok). FAO, Rome.



# Biodiversity and nutrition

Dietary energy supply *can*  
be satisfied without  
diversity

Micronutrient supply  
*cannot* be satisfied  
without diversity

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*"Agricultural biodiversity is a matter of life and death  
for us.... We cannot separate agrobiodiversity from food  
security."*

*—Zambian delegate to the Conference of Parties,  
Convention on Biological Diversity, May 1998*

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# Future of Science

- Improve the evidence base
- Consider other sectors
- Evaluate impact
- Monitor routinely
- Question the models
- Participate in policy development
- Learn from the past



# Ellen Swallow Richards



Foremost female environmental chemist in the USA in the 1800s;  
Introduced the word “ecology” into the English language;  
Pioneered the field of nutrition as human ecology;  
First woman admitted to MIT and its first female instructor;  
First woman in America accepted to any school of science and technology, and the first American woman to earn a degree in chemistry.



# **TRADITIONS & HERITAGE: FAO REGIONAL CONFERENCE FOR EUROPE**

**2004: Food Safety and Quality: aspects concerning in particular quality, nutritional balance, the importance of agricultural land and cultural heritage ("Terroirs")**

- “Agreed that food quality was not limited to food safety, but included nutritional and added-value characteristics such as forms of production (oriented to environmental protection, animal welfare and biodiversity) and production areas...”
- “FAO’s assistance was requested to focus on the fundamental need to assess the food composition, including the content of traditional foods for achieving food quality and nutritional balance...”

**2008: Promotion of Traditional Regional Agricultural and Food Products:  
A Further Step Towards Sustainable Rural Development**

- “Recommended that FAO integrate issues of traditional food into all its areas of activity (e.g. food security programmes) and initiate a programme for research and technical assistance on this issue.
- “Remarked that the goal of increased global food production, including bio fuel, should be balanced against the need to protect biodiversity, ecosystems, traditional foods and traditional agricultural practices.”





Thank you

