Role of Neglected and Under utilized Species (NUS) in nutrition and food security in India

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NutriPlus Knowledge Program
Agribusiness Innovation Platform
Distribution Statistics of Malnutrition

Undernourished (%)

India: 60 million
Rest of World: 86 million

Severe Acute Malnutrition (%)

India: 9 million
Rest of World: 11 million
Malnutrition in India

• Estimated approx. 7 million children under 3 years of age in India are SAM (weight for height < 3SD)*

• One-third of currently married women in the age-group 15 – 49 years have low BMI (< 18.5 kg/m²)**

• 47% girls of 15 – 19 years have low BMI**

• 51.2% women and 49.4% of children aged 6 - 35 months in India are Anemic

• 19% of children aged 12–35 months had received 3–5 doses of Vitamin A***

Malnutrition in India ... contd

• **Approx. 300,000 children below five years of age** are being killed every year by **diarrheal diseases**.

• **Lack of toilets** increase chance of infectious disease among children. 32% elementary schools in India either do not have toilets or toilets are dysfunctional.

• **Government’s spending** on health and nutrition remain inadequate
  – out of pocket (OOP) expenditure on health stands as 58% in India of which more than 60% is on Medicine – WHO, 2012

Source: http://www.who.int/nutrition/publications/severemalnutrition/9789241598163_eng.pdf
DISE 2013-14,
Nutrition status of selected states of India

60% Children (<5 Yrs) of MP are underweight.

Source: National Family Health Survey-3, 2005 – 06
Factors behind under nutrition

1. **Nutritional Status of Women** during adolescence, pre-conception and during pregnancy

2. **Poor** infant and young child feeding (IYCF) practices

3. **Poor intake** of essential calories, proteins, fats, and micronutrients

4. **Unsafe drinking water**, lack of sanitation and unhygienic environment
Stunting, wasting and underweight - major cause of concern in India

<table>
<thead>
<tr>
<th>Category</th>
<th>%</th>
<th>Number (in million)</th>
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<tbody>
<tr>
<td>Stunting - Malnourished children under 5 years of age below -3 SD according to “Height-for-Age index”</td>
<td>27.6</td>
<td>24.6</td>
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<tr>
<td>Wasting - Malnourished children under 5 years of age below -3 SD according to “Weight-for-Height index”</td>
<td>6.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Underweight - Malnourished children under 5 years of age below -3 SD according to “Weight-for-Age index”</td>
<td>18.5</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Source: NFHS – 3, India. 2005 – 06 and Census of India 2011
Direct Nutrition Programs in India

- National Nutrition Mission (NNM) - [http://wcd.nic.in/](http://wcd.nic.in/)
- Nutrition Education Scheme (FNB) - [http://wcd.nic.in/](http://wcd.nic.in/)
- Mid-day Meal (MDM) – [http://mdm.nic.in/](http://mdm.nic.in/)
- National Institute of Public Cooperation and Child Development (NIPCCD) – [www.nipccd.nic.in](http://www.nipccd.nic.in)
- Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG) – SABLA – [http://wcd.nic.in/schemes/sabla.htm](http://wcd.nic.in/schemes/sabla.htm)
- Food Subsidy under Food Civil Supplies and consumer affairs department - [http://megfcsca.gov.in/](http://megfcsca.gov.in/)

Source: Expenditure Budget-Vol II, Union  Budget of various years of following depTs (Web:http://indiabudget.nic.in/vol2.asp)
Indirect Programs impacting FNS

- Schemes by Food and Civil Supplies Departments other than food subsidy
- Programs under Department of Agriculture
  - National Food Security Mission (NFSM)
  - Rashtriya Krishi Vikas Yojana (RKVY)
  - Price Stabilization fund for Cereals and Vegetables
  - NHM /Mission for Integrated Development of Horticulture
- Schemes under Department of Water Resources
  - National Rural Drinking Water Program
  - Nirmal Bharat Abhiyan (renamed as Swachh Bharat Abhiyan)
- Schemes under Department of Rural Development
  - National Rural Livelihood Mission
  - MNREGA

Source: Expenditure Budget-Vol II, Union Budget of various years of following depts (Web: http://indiabudget.nic.in/vol2.asp)
i) Dept. of Agriculture and cooperation, Demand no-1; II) Dept of Food and Public Distribution, Demand no-18, iii) Min of Drinking Water and Sanitation, Demand no-30, iv) Rural Development, Demand no-84
MP data
## MP data

<table>
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<th>Category</th>
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<th>% of Indian statistics</th>
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<tbody>
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<td><strong>Stunting</strong> - Malnourished children under 5 years of age below -3 SD according to “Height-for-Age index”</td>
<td>26.3</td>
<td>15.6</td>
<td>6.3</td>
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<td><strong>Wasting</strong> - Malnourished children under 5 years of age below -3 SD according to “Weight-for-Height index”</td>
<td>12.6</td>
<td>7.5</td>
<td>12.7</td>
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<td><strong>Underweight</strong> - Malnourished children under 5 years of age below -3 SD according to “Weight-for-Age index”</td>
<td>27.3</td>
<td>16.2</td>
<td>9.8</td>
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</table>

Source: NFHS – 3, India. 2005 – 06; Census of India 2011-12
Nutritional status of below 5 years children (MP)

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<tr>
<td>Underweight (UW)</td>
<td>27.3</td>
<td>32.7</td>
<td>32.1</td>
<td>19.8</td>
<td>12.6</td>
<td>8.3</td>
<td>22.4</td>
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<td>26.3</td>
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<td>Stunting (SA)</td>
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</table>

WHO Growth Standards (2006):
MODERATE = Median <-2 SD to ≥ -3 SD
SEVERE = Median <-3 SD
• Only **40% of Children** (age 9 months and above) received at least one dose of **vitamin A supplement** (DLHS III)

• **43.1% of infants** of <6 months old were exclusively **breastfed** in the state (DLHS III)

• **23.4% babies** born have **low birthweight** (NFHS III)

• **Infant mortality rate is as high as 67 per 1000 live births** in the state (NFHS III)

• Only **26% deliveries in the state are Institutional** (NFHS III)

• **40.3% children** of age 12-23 months received **all basic vaccines** (NFHS III)

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Source: NFHS – 3, India. 2005 – 06; DLHS III, India 2007-08
Food and Nutrition Programs in MP

<table>
<thead>
<tr>
<th>National and MP State Programs on Food and Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Integrated Child Development Scheme - National Program</td>
</tr>
<tr>
<td>2 Nutrition Meal Program in Schools - National Program</td>
</tr>
<tr>
<td>3 Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (SABLA) - National Program</td>
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<tr>
<td>4 Food Subsidies by Department of Food and Civil Supplies, GoMP</td>
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<tr>
<td>5 Atal Bal Aarogya Evam Poshan Mission – MP state program</td>
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</table>

Source: Budget Publications, various years of following departments (Web: www.finance.mp.gov.in)
i) Dept. of Food, civil supplies and consumer protection, Demand no-39;
ii) Dept of WCD, Demand no-55
PAB minutes of Meetings, various years (Web: http://mdm.nic.in/)
<table>
<thead>
<tr>
<th>No.</th>
<th>Program</th>
<th>Details</th>
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<tbody>
<tr>
<td>1</td>
<td>National Iron Plus Initiative- Dissemination, trainings, meetings etc.</td>
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<tr>
<td>2</td>
<td>Distribution of IFA syrups and tablets among children (6-60 months) and 5-10 years; Distribution of IFA tablets/Sucrose among pregnant and lactating women</td>
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<tr>
<td>3</td>
<td>Weekly Iron and Folic Acid Supplementation Program (WIFS)</td>
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<td>4</td>
<td>Infant and Young Child Feeding/IYCF</td>
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</tr>
<tr>
<td>5</td>
<td>Management of diarrhea &amp; ARI &amp; micronutrient malnutrition</td>
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<td>6</td>
<td>Vitamin A solution for Addressing Micronutrient Malnutrition to improve the survival of child and reduction in U5MR</td>
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<td>7</td>
<td>Care of Sick Children and Severe Malnutrition (e.g. NRCs, CDNCs etc.)</td>
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<tr>
<td>8</td>
<td>Micronutrient Supplementation Program (cost of activities except cost of procurement of supplements)</td>
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<tr>
<td>9</td>
<td>National iodine deficiency disorder control program</td>
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<td>10</td>
<td>Incentive for referral of SAM cases to NRC and follow up of discharge SAM children from NRCs/Community day care for SAM management</td>
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### Mandla district

Demographic profile

<table>
<thead>
<tr>
<th>S. No</th>
<th>Indicator</th>
<th>Year</th>
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<th>Source</th>
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<tbody>
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<td>1</td>
<td>Total House holds</td>
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<tr>
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<td>Growth Rate (%)</td>
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<td>Child population (0-6 years)</td>
<td>2011</td>
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<td>9</td>
<td>Child population (0-6 years) to total Population</td>
<td>2011</td>
<td>13.74%</td>
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Source: http://mandla.nic.in/Mandla_district_profile.pdf
## Mandla district

### Children Nutritional Status

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<th>S. No</th>
<th>Indicator</th>
<th>Year</th>
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<th>Source</th>
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<td>Children age 0-59 months underweight (%)</td>
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<td>56.5</td>
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<td>Children age 0-59 months severe underweight (%)</td>
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<td>3</td>
<td>Children breastfed within one hour of birth (%)—Total</td>
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<td>56.8</td>
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<td>4</td>
<td>Children age &lt;6 months exclusively breastfed (%)—Total</td>
<td>2007-08</td>
<td>44.3</td>
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<td>5</td>
<td>Children age 9-35 months who received Vitamin A in last 6 months (%)—Total</td>
<td>2007-08</td>
<td>55.9</td>
<td>District level House Hold Survey</td>
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<td>Children age more than 21 months who received three doses of Vitamin A in last 6 months (%)—Total</td>
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<td>Children given ORS during diarrhea (%)</td>
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## Mandla district

### Children Health Status

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<td>4</td>
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<td>7</td>
<td>Children age 12-23 months receiving BCG vaccine (%)—Total</td>
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<td>Children age 12-23 months receiving DPT 3 vaccine (%)—Total</td>
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<td>Children age 12-23 months receiving Polio 3 (%)—Total</td>
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<td>Children age 12-23 months receiving measles vaccine (%)—Total</td>
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<td>11</td>
<td>Children age 12-23 months receiving full immunization (%)—Total</td>
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<td>30.5</td>
<td>District house hold survey</td>
</tr>
</tbody>
</table>
Out of the 7,000 food crops that we know of in the world, 50% of our plant-derived calories come from **just 3 species** - Rice, Maize and Wheat.

It is often stated, that only 30 crops “feed the world”. These are the crops which provide 95% of dietary energy (calories) or protein.

Source: http://www.bioversityinternational.org/research-portfolio/marketing-diversity/neglected-and-underutilized-species/
What are NUS?

Those non-commodity crops, which are part of a larger biodiversity portfolio, once more popular and today neglected by users’ groups for a variety of agronomic, genetic, economic, social and cultural factors. These are:

- important in local consumption and production systems
- highly adapted to agro-ecological niches and marginal areas
- ignored by policy makers and excluded from research and development agendas
- represented by ecotypes or landraces
- cultivated and utilized drawing on indigenous knowledge
- hardly represented in ex situ gene banks
- characterized by fragile or non-existent seed supply systems

NUS examples – India

**Millets:** Minor (small) millets

**Pulses:** *Dolichos uniflorus, Psophocarpus tetragonolobus, Vigna aconitifolia, V. umbellata*

**Oilseeds:** *Amoora rohituka, Azadirachta indica, Aesandra butyracea, Calophyllum inophyllum*

**Vegetable crops:** *Amaranthus polygonoides, Bambusa tulda, B. spinosa, B. Vulgaris.*

**Fruit crops:** *Aegle marmelos, Artocarpus lakoocha, Carissa congesta, Emblica officinallis.*

**Spices, condiments and beverage plants:** *Amomum aromaticum, A. xanthioides, Anethum sowa, Areca triandra.*

**Fodder and fodder-cum-fuel species:** *Agrostis alba, Albizia lebbek, Desmodium parvifolium*

**Gum, wax and resin plants:** *Acacia senegal, A. nilotica, Butea monosperma, Commiphora wightii, Prosopis juliflora.*
Crops of Madhya Pradesh

Major Crops:
- Wheat
- Rice
- Corn
- Jowar
- Gram
- Pigeon pea
- Soybean
- Groundnut
- Cotton
- Sugarcane

NUS:
- Minor (small) millets
- *Citrullus colocynthis*
- *Ficus cutulata*
- *Cassia tora*
- *Cassia hirsuta*
Small Millets

- **Crops of antiquity** - traditional cropping systems

- **Ethnic foods & diversity**

- **Suitable for dry lands** & important in hill and tribal agriculture

- **Food & Fodder security** of disadvantaged regions

- **Require less water**, mature early and cultivated in scarcity conditions

- **Highly Resilient** in adapting to different ecological conditions

- **Ideal crops for climate change** and contingency plantings

- **Unique nutritional properties**
  - high fiber, quality protein, mineral composition, Nutraceuticals

- **Nutritional security of disadvantaged groups.**
Distribution of Small Millets in India
Trend of area, production and productivity of Small millets in Madhya Pradesh

Source: http://www.mpsbb.nic.in/pdf/SM.pdf
Importance of NUS

- **Crop diversification** contributing significantly to improved health and nutrition, livelihoods, household food security and ecological sustainability

- Combating *World's Hunger* including “hidden hunger”

- **Support the lives of rural people** by providing food, fodder, fiber, medicine, fuel wood, and shelter

- Being low input crops, these are important for agricultural diversification and provide a unique opportunity to **combat food and nutritional insecurity** within the communities.
Promotion strategies

- focusing on local values, indigenous knowledge and uses
- recognizing underutilized species as a public good
- focus on groups of species as models through case-study approaches
- promote cooperation among stakeholder groups and create national, regional and international synergies
- analyze and enhance demand using market-oriented strategies
- empower rural poor and strengthen their capacity to negotiate with the private sector and government
- mainstream gender-sensitive approaches in management and use
- inter-disciplinary work

Ref: http://www.agriculturesnetwork.org/magazines/global/valuing-crop-diversity/underutilized-plant-species-what-are-they
Nutrition across the whole agricultural research for development value chain

- Agronomic interventions to improve grain micronutrient concentration
- Food safety (Aflatoxin and quality deterioration)
- Post-harvest processing and value addition
- Ready-to-Use Foods

- Nutridense and climate resilient crops (cereals and legumes)
- Integration of fruits and vegetables in home gardening
- Small ruminants, poultry and livestock integration
- Linking to markets (Inclusive Market Oriented Development)
- Marketing – building health awareness and product demand
- Bioavailability testing

- Biofortification incorporated into the breeding program
- Seed production and delivery systems for dissemination
- Developing on-farm practices and technologies
- Marketing – building health awareness and product demand
- Bioavailability testing

- Integrated rainwater management
- Soil nutrition boosted

Cross-cutting issues

- Empowering women – women are consulted, involved and supported to lead both on farm and with agribusiness
- Attracting youth to agriculture

Approach for Adoption

- Science-led participatory consortium approach & collective action
- Capacity building for empowerment
- Integrating ICTs - to build awareness and share knowledge, especially with women and youth
- Concurrent monitoring and evaluation – for feedback and adjustment
- Policy support – work closely with government to encourage the needed policies

Agricultural transformation agenda
Holistic approach for addressing Nutrition and Food security

- Sanitation
- Lack of awareness about nutritious diets
- Biodiversity (NUS)
- Food and Nutrition Programs
- Governmental policies
- Effective implementation of policies
- Food consumption practices
- Budgetary support
Stakeholders across NUS value-chain

- Equipment manufacturers
- Policies and Financial incentives
- Research Institutes
- Public and Private funding agencies
- Start-up entrepreneurs
- Food processing industry
- Farmers
- NGOs & FPOs

NUS
Urgent Areas for Action

• **Institutionalize leadership for nutrition** within the PMO and Chief Minister offices

• **Prioritize universal coverage of selected evidence-informed essential nutrition interventions (ENIs)** with special focus on **under 2 years, pregnant women and adolescents**

• **Finance and deliver at scale the ENIs** with active attention to equity

• **Ensure equitable access** to Food Security, primary health care, safe drinking water, sanitation, gender issues and age at conception

• **Position nutrition as a development indicator** and reliable data collection
Way forward ...

- Consorted and coordinated efforts are needed towards conservation, improvement and utilization of NUS.

- Use locally grown crops (including NUS) and promote entrepreneurship/community level value addition centers towards development of food products for addressing malnutrition.

- Effective implementation of various nutritional programs in consultation with all stakeholders.

- Include malnutrition as an indicator parameter in evaluating progress of various programs under different ministries.

- Promulgate a “Nutritional security bill” along the lines of “Food security bill”.
ICRISAT’s work on Nutrition

• The NutriPlus Knowledge (NPK) program of ICRISAT works towards understanding the nutritional potential of crops.

• Explores opportunities for value addition through identification of processing technologies and value added products to increase market value of the mandate crops.

• Provides training, technology support for food product and packaging development, labelling and regulatory support, and innovative post harvest processing solutions.

• Conducts entrepreneur development workshops, quality control and quality assurance (food safety) training programmes, conferences and symposiums.
Few of the capabilities of NPK program laboratory

**Product Development Lab**
- Product development
- Proximate analysis – Protein, Fat, Fiber, Carbohydrates, Ash
- Starch profiling
- Amino acid profiling
- Fatty acid profiling
- Rancidity profiling
- Various prebiotic components such as β-glucans, Oligosaccharides, Arabinoxylans etc
- Shelf-life studies

**Analytical Lab**
Few of the products developed at NPK program

**Fight against Hidden hunger**
- Instant Millet porridge
- Micronutrient (Fe, K, Ca) rich sweet sorghum syrup & beverage

**Fight against Protein Energy Malnutrition**
- Energy dense spread – Peanut and Sorghum based Ready-to-Use-Therapeutic Food (RUTF)

**Fight against Non-communicable diseases viz. Diabetes, Cardiovascular, Cancer etc**
- Low Glycemic and gluten-free food products
- Crispies prepared from Polyphenol-rich Sorghum
Thank you!