Environmental sustainability
Nothing will operate without the sustainable use of water, soils, land and energy.
This is the basis for any industry to survive – water, soils, land and energy. Whether it is natural resources for industrial use or community use – it is critical for any sustainability. This is not about conservation but about sustainable use. Environmental sustainability is critical to work within communities - building a positive reputation.

Social development
Agricultural success is necessary for rural communities to be able to afford health and education and for the country’s food security – agriculture is the basis of all this.
The success of agriculture is critical for the survival of all rural communities (half the population), and to feed the whole population.
Empowering women will make the largest difference to the whole family and avoid the most dramatic of human abuses.
Engaging youth is critical for the long-term viability of agriculture.
Malnutrition in rural areas needs to be tackled at the source – agriculture and rural communities.

Market development
Markets are core to economic growth.
Working the whole agricultural value chain is needed for profitable viable success.
This not only enables farmers to have access to required inputs but also brings their products to market in an efficient and effective way.
Building entrepreneurial skills and agribusiness are key part of developing value chains.
Untapped opportunities exist for the value chain of Smart Foods.

Scientific advancement
Innovations will lead to major developments and revolutions.
Some of the key areas that can revolutionize the profitability of agriculture are Information and Communication Technology, on-farm mechanization and genomics.

Why take a science-backed approach
Science-backed solutions and implementation mean greater success and more sustainable solutions.
Our science-backed approach is the biggest difference from other development initiatives.
Our approach includes:
- Science-backed solutions as well as implementation
- Collaborative community-led approaches to achieve adoption
- Strong partnerships internationally, with government and on-the-ground
- Using time-bound measurable targets - real-time monitoring and evaluation
About ICRISAT

ICRISAT is an international non-profit organization that undertakes scientific research focused on making agriculture profitable, and overcoming poverty, malnutrition, and environmental degradation.

ICRISAT has specialized knowledge on the drylands, which covers 55 countries in Asia and Africa, and are inhabited by 2 billion people, of whom 644 million are poor. These regions are most vulnerable to climate change, subject to droughts, degraded soils and poor social infrastructure.

ICRISAT also has specialized skills on crops that survive best in the drylands – nutri-cereals (millet including sorghum) and legumes (chickpea, pigeonpea and groundnut).

The ICRISAT Development Center is the arm that focuses on implementation and large-scale adoption of scientific advancements. We also apply scientific research while undertaking implementation thus ensuring sustainable solutions. Our role is a catalyst to make things happen and to provide technical back stopping.

Our capabilities

- **Multidisciplinary high-class science** – from natural resource management, genetics, bioinformatics and phenotyping to economics and social science.
- **On the ground in Africa and Asia** – with offices in India (global headquarters), Kenya, Malawi, Zimbabwe, Mozambique, Ethiopia, Mali, Niger and Nigeria.
- **Strong networks** – we work in partnership at all levels: local, national, regional and international.
- **Participatory methods** – have been developed and are used as part of our work, involving farmers through to the government and private industry where change is needed.
- **Recognized as Independent** – as an international non-profit, non-government and non-religious organization that has worked in Asia and Africa for over 40 years, our scientific and independent credibility are well founded.

ICRISAT takes a holistic approach with expertise across the whole agricultural R4D value chain:

- Analyzing key problems and opportunities
- Managing soil and water
- Crop improvement & seed access
- Diversifying farms
- Developing on-farm practices and technologies
- Introducing processing
- Facilitating market access
- Driving market development
- Sustainable intensification
- Intergrate social dimensions

Some of our partners in sustainable development:

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Joanna Kane-Potaka | Director, Strategic Marketing and Communication | j.kane-potaka@cgiar.org

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September 2015
Opportunities to partner for sustainable development

1. Sustainable use of Natural Resources
2. Rejuvenating Degraded Landscapes
3. Waste Management-recycling and reuse

4. Partner for Rural Village Growth
5. Building a business for Youth in agriculture
6. Empowering Women to drive the rural economy
7. Building Healthier Communities – through sustainable solutions in agriculture

8. Unlock the power of inclusive Value Chains for rural families
9. Agribusiness Incubation building entrepreneurs
10. A movement for Smart Foods

11. Digital agriculture revolution
12. Farm Mechanization for enhancing farm efficiency and profitability
13. Discovery conservation and use of Crop Genetic diversity

14a. Take a HOLISTIC approach incorporating any of the developments relevant and needed by the community.

14b. Join a CONSORTIUM

International Crops Research Institute for the Semi-Arid Tropics

About ICRISAT: www.icrisat.org  ICRISAT’s scientific information: EXPLORE/icrisat.org

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June 2016
SUSTAINABLE use of
NATURAL RESOURCES

Resources managed for use
Resources available for communities
Adapted to climate change
Be water neutral – energy neutral – carbon neutral

Finite and Depleting Natural Resources
- Economic growth, globalization and changing food habits are increasing pressure on already scarce land and water resources.
- Changing land use and over exploitation of groundwater resources have reduced surface and groundwater availability and resulted in intrusion of seawater, increasing salinity and depleting wetlands.
- Urgent need to develop, demonstrate and scale up sustainable natural resource management options to achieve food and nutritional security for growing population.

India has 4% of the global fresh water resources and 17% of the global population

Agriculture uses 70% of the water resources.

The impact pathway - How can it be implemented

1. Assess the opportunities and challenges – biophysical and socio-economic
2. Set up a community-driven approach to decision making
3. Select initial interventions that will have quickest and significant impacts
4. Demonstrate productivity enhancements of the interventions and gain greater buy-in for more interventions
5. Adopt a holistic approach – bringing interventions needed at any stage across the agricultural development value chain
6. Establish communities as sites of learning and conduct field days for other villages, government and development organizations
7. Scale up the approach to more areas.

Cross cutting activities
- Monitoring, evaluation and refinement of interventions
- Targeted activities for women and youth
- Capacity building as needed
Positive impacts from interventions

**Adarsha Watershed, Kothapally, India**

Before 1999, this village was suffering from acute water shortage, land degradation and poor agricultural and livestock productivity.

**Process**
For implementing various activities, a consortium was formed, of research (ICRISAT, CRIDA, NRSC) and development (WDD and MV Foundation) institutes along with the farming community (1999-2004).

**Interventions**
- Various soil and water conservation practices (in-situ and ex-situ)
- Productivity enhancement
- Crop diversification and intensification along with knowledge based entry point
- Income generating activities

**Impact**
- The average yields of sole maize crop increased 2-4 times
- Family incomes doubled in four years.
- Groundwater availability increased from 3.5 m to 6.0 m
- Cropping intensity increased from 85% to 150%, with a major shift from low- to high-value crops
- Reduced soil loss (10 t ha\(^{-1}\) to 2 t ha\(^{-1}\)), reduced surface runoff (30-40%), increased base flow, improved water quality (pesticide residue free), increased green cover and carbon sequestration.

**Lucheba Watershed, China**

A cluster of villages with 340 households from Lucheba in Pingba County, Guizhou province in southern China was selected. The village had severe water scarcity and migration was high in search of livelihood options.

**Process**
ICRISAT along with consortium partners and the community undertook drinking water schemes as an entry point activity. Community participation and collective action helped to resolve serious water scarcity issues.

**Interventions**
- In-situ and ex-situ soil and water management practices
- Improved cropping systems
- Crop diversification and intensification
- Integrated nutrient and pest management practices
- Other income-generating activities such as poultry and pig rearing.

**Impact**
- Annual average household income increased 3 fold (from US$500 to US$1650)
- Crops like rice, corn, rape, soybean, sunflower and kidney bean were replaced largely with high-value crops like cabbage, watermelon and vegetables like tomato, pumpkin, chillies and eggplant (from 40 ha in 2003 to 113 ha in 2005)
- Public-private partnership helped the community to establish animal health centers and the computer-aided internet-enabled farmers’ training center, which was linked with Vegetable Growers’ Association for better marketing.

http://www.slideshare.net/icrisatsmco/yewol-slideshow

The Re-Birth of the Yewol Watershed
Integrated Watershed Management in Ethiopia’s Northern Highlands
REJUVENATING DEGRADED LANDSCAPES

Revived land
New agricultural livelihoods
Rural communities pulled out of poverty

Why is land rejuvenation important?
- Globally, 2 billion ha of land are degraded annually and as a result 6 million ha area goes out of cultivation each year.
- In India, 69% of the total land area (228 million ha) is degraded.
- 6 billion tons of top soil is lost annually along with valuable plant nutrients.
- Common Property Resources (CPRs) are degraded and not able to support landless families in India.
- Increased frequency of high-intensity rains, extended dry spells and lack of green cover will cause more land degradation.
- Urgent need to break unholy alliance between land degradation, food insecurity and poverty by rejuvenating degraded lands.

The impact pathway - How it can be implemented extensively
- Implement holistic and integrated land management to regenerate degraded lands.
- Initiate rainwater conservation along with innovative rehabilitation practices to increase productivity, profitability and to conserve natural resources.
- Improve grazing practices, strengthen institutions and rehabilitate mining sites.
- Develop a well-defined integrated land use policy and ensure its implementation.

What is achieved so far?
- ICRISAT and our partners have developed science-led farmer participatory watershed management models for controlling land degradation and improving rural livelihoods.
- Rehabilitation of degraded lands using soil, water conservation measures and biofuel plantations (*Jatropha* and *Pongamia*) on common lands.
- Mechanization for carbon sequestration and sale of verifiable carbon units piloted.
- Through rehabilitation of uplands, runoff reduced by 30% and soil erosion by 50%; increased groundwater availability and enhanced base flow without affecting water resources in downstream areas.
- Employment generation for women self-help groups.
- Rehabilitated biodiversity of flora and fauna and enhanced awareness among the villagers for conservation of biodiversity.
1 Rejuvenating degraded common property and conservation of biodiversity, Gokulpura, Bundi, Rajasthan

Challenges
The only source of open grazing, the 95 ha common grazing land at Gokulpura-Goverdhanpura watershed was degraded and unable to supply good quality fodder to support increasing livestock population. The fodder and grasses grown were neither palatable nor sufficient for the cattle.

Solutions
The project initially recognized these problems and got involved with the community to find appropriate solutions. The stakeholder community consisting of grazers and farmers through the Panchayat resolved to erect a stone wall around the 45 ha grazing land and did not allow any cattle to graze in the fenced area. Thus the area was physically and socially fenced and villagers contributed their labor in the development activities.

Impacts
There was perceptible improvement in the density of vegetation in the protected area in contrast to unprotected area. The treated area has attracted many birds and animals, prominent among these are blue bulls. The community efforts over six years have brought about remarkable changes in the flora and fauna of this piece of land. Most importantly, it is now producing good quantity and quality of fodder for the livestock. These activities generated good income for the community, particularly marginal and smallholder farmers.

2 Community empowerment and new technologies transform a problem village Powerguda, Adilabad, Telangana

Challenges
Low variable rainfall, poor soils, high financial risk, and poor physical and social infrastructure characterize the Powerguda village in Adilabad district. The agricultural productivity was very low.

Solutions
ICRISAT and its partners helped the community to implement the integrated watershed management program in their village.

Impacts
The experience from Powerguda has demonstrated that a judicious mix of community empowerment, new technologies and institutional linkages can help to alleviate rural poverty. Public investment in watershed management and agricultural development provided the technology edifice. Building hamlet-level self-help groups and federating these groups at higher levels, built the community’s self-confidence and increased their bargaining power with local merchants, politicians and bureaucrats.

The linkages with financial institutions helped to leverage the groups’ savings to get bank loans. It is remarkable that the people of Powerguda were able to get out of the poverty trap in three years and increase their household income by 77% to ₹ 25,874 (US$392). It is equally remarkable that the village women who had not stepped inside a bank four years ago now enjoy favorable credit terms from local banks compared with other customers.

The pioneering work in extracting oil from Pongamia seeds and selling the carbon credits to World Bank has given the people a sense of pride in the village and put Powerguda on the map of the world. Powerguda’s action has inspired several other neighboring villages to plant Pongamia trees on a large scale.

ICRISAT
International Crops Research Institute for the Semi-arid Tropics

About ICRISAT: www.icrisat.org
ICRISAT’s scientific information: EXPLORE/icrisat.org

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September 2015
Why is waste management critical?

- In developing countries, a large portion of population resides in villages where formal waste management systems do not exist.
- Approximately 90% of disease burden is due to absence of clean water and poor sanitation.
- Recycling and reuse of available waste in villages provides sustainable solutions for a waste management system and reduces environmental degradation.
- Inappropriate reuse of untreated wastewater is unsafe for farmers and consumers.

The impact pathway - How can it be implemented through a green business model

- Decentralized Waste Management Systems (DWMS) for rural areas
- Increased use of waste through reuse of treated wastewater in agriculture and recycling solid waste as compost or bioenergy
- Involving community-based organizations, like women’s self-help groups, for planning, implementing and managing the DWMS as a green business model.

Green Business Model for Decentralized Waste Management System (DWMS) in Villages
What has been implemented so far?

**Decentralized wastewater treatment system**

- The wastewater treatment system uses a phytoremediation (plant-based) process.
- The quality of water regenerated is suitable for irrigation and agricultural activities.
- ICRISAT-led consortium has developed and constructed a wetland model for wastewater reuse in agriculture.
- Constructed wetland is used for treating domestic as well as industrial wastewater.
- Constructed wetlands consist of a filter bed of locally available sand/gravel and vegetated with wetland plants such as *Canna indica* and *Typha*.
- Around 20,000 liters of wastewater regenerated and reused daily to grow crops in one hectare of farmland throughout the year (Kothapally, India).
- Biomass generated from the constructed wetland may be used for biogas/compost generation.

**Solid waste management**

- Biodegradable solid waste subjected to either composting, vermicomposting for producing a solid biofertilizer or directed to anaerobic digestor for producing biogas.
- Organic manure in form of compost improves soil health and reduces use of chemical fertilizers, which also reduces the cost of cultivation.
- Biogas can be used for cooking at the household or community level, reducing indoor air pollution.
- A biogas plant can be specifically designed to suit any type of organic waste.

**Observed impacts**

1. Enhanced nutrient use efficiency through recycling of waste as a part of green technology
2. Closing the nutrient cycle by transferring nutrients back to the agricultural fields
3. Improved quality of health particularly in women and children
4. Improved livelihoods and economy due to technology interventions at the village level
5. Improved crop yields leading to higher income and safe practices leading to fresh and non-toxic foodgrains and vegetables

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**International Crops Research Institute for the Semi-Arid Tropics**

About ICRISAT: [www.icrisat.org](https://www.icrisat.org)  
ICRISAT’s scientific information: [EXPLORE/it.icrisat.org](https://explore.it.icrisat.org)

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September 2015
PARTNER for RURAL VILLAGE GROWTH to

Achieve more stable, healthy and prosperous communities
Bring rural communities out of poverty
Attain environmental sustainability
Improve livelihood options
Adapt to climate change

Take a holistic and community driven approach that is science-backed.

Steps to achieve this:
1. Analyze the village to identify issues and opportunities
2. Prioritize the low-hanging fruit with best impact
3. Work across the whole agricultural value chain to fill the gaps
4. Set up a community and local authority consortium

ICRISAT’s holistic approach along the agricultural value chain

ICRISAT’s holistic approach means working across the whole agricultural value chain from achieving sustainable intensification on farm to building agribusiness.

Sustainable intensification requires focus on:
- Managing soil and water for more and sustainable use
- Crop improvement to achieve higher yielding, drought and pest tolerant and more nutritious varieties
- Seed access by setting up seed systems to ensure seeds are available and of high quality
- Diversifying farms to ensure less risk, more incomes, a more diverse diet and healthier soils
- Developing on-farm practices and technologies for better yields and profits as well as safer and healthier practices.

Building agribusiness focuses on:
- Introducing processing techniques as labor saving devices and for income earning opportunities
- Facilitating market access for farmers
- Driving market development to build opportunities for all.

All of this is done by understanding and integrating the social dimension.

Approach for adoption

Participatory approach and partnering
- working side by side

Building capacity
- at a national and local level

Integrating communications
- to build awareness and share knowledge

Monitoring and evaluation
- for feedback and adjustment

Policy support
- work closely with governments to encourage the needed policies

Cross-cutting issues

Mainstreaming nutrition
Empowering women
- women are consulted, involved and supported to lead
Attracting youth to agriculture
Two of the projects ICRISAT undertook with SAB Miller included:

- **Groundwater Management initiative in Rajasthan**

  Result is encouraging with water saving in agriculture at 80,340 kiloliters on 193 ha area covered under crop demonstration trials. Crop productivity has been enhanced by over 20%.

- **Improving livelihoods through water management in community watersheds in 4 villages in Telangana.**

**HIGHLIGHTS**

- Water storage capacity of more than 30,000 m³ leading to groundwater recharge of about 75,000 m³
- Increase in moisture content by 10% in the case of black soils and 5% in case of red soil.
- Increased crop yield - chickpea by 35%, cotton 12%, paddy 15%, sugarcane 8%.

SAB Miller Annual Report 2012-13

Hari Bai from Siyalwada village in Madhya Pradesh, India, knows how to deal with a fickle monsoon. The holistic approach of the watershed initiative equips her to help herself and others in her community too.

There was not enough water earlier and therefore the yield was not enough to feed us all. Ever since ICRISAT helped us build a check dam we have water now. The yield has increased, almost double.

**For the full story see**
http://www.icrisat.org/womenleaders-haribai.htm
New ideas and energy in agriculture
Agribusiness opportunities developed
New technologies taken on
A revival of agriculture and rural communities

Doctors want their children to be doctors, business people want their children to be business people, politicians want their children to be politicians, and actors want their children to be actors, but farmers do not want their children to be farmers.

If we don’t attract youth to agriculture we risk a production crisis.

Solutions
To attract youth back to agriculture we need:

Mechanization of farming operations
in the field and after harvest to increase profitability.

A digital agriculture revolution that will interest youth by providing the business intelligence and market integration required to run a successful farm.

Profitability through intensification, higher unit prices offered through e-marketing and traceability and manage risk – especially associated with climate change. Farming must be competitive with other career options while allowing families to enjoy the ecosystem services of rural living.

Agribusiness ventures with appropriate support to youth through mentoring to develop new market opportunities in providing nutritious food and getting remunerated for environmental services such as improving soil health and water quality through best agricultural practices.

Buzz and collaborations for youth in agriculture. Start a local young farmer group and create a buzz around agriculture, leadership and learning. Build up these groups into a strong network.

Shri Venkaiah Naidu
Minister, Government of India

BUILDING a business for YOUTH in agriculture
Video of young farmers
ICRISAT works with in Malawi

https://youtu.be/T2cebTvDLs0
EMPOWERING WOMEN to drive the rural economy

Benefiting the whole community
More businesses
Better nutrition
Better family wealth
Dignity and empowerment

Issues
- Women are far more likely than men to channel their income from agriculture into the nutrition, health and education of their children.
- Women farmers in developing countries are 20-30% less productive than men. This is because women do not have the same access to key assets.
- Health is typically treated as a separate issue and is not integrated into agriculture and rural livelihood options.
- Women are more vulnerable to discrimination and social mistreatment.

Opportunities
If we can close the gender gap in rural areas we can:
- Have 4% more food produced each year
- Bring 100 million people out of hunger in the world
- Build more businesses
- Have healthier future generations (UN-FAO)
- Women’s control over resources has shown to improve family health and nutrition, agriculture development and family planning. (World Bank)

So how do we change things - the impact pathway:

The approach
1. Participatory analysis and solution building at village level
   - Bring together the women and the broader community in a village, the players along the whole value chain (eg, traders and processors) and scientific and business experts
   - Analyze the barriers and opportunities
   - Develop solutions together that are science-backed and owned by the community.

2. Implement the solutions
   This can include:
   - Providing training
   - Giving access to needed assets
   - Creating/strengthening self-help groups
   - Building knowledge on nutrition and health. This will include understanding cultural norms and how to manage these, food options and social interventions to overcome malnutrition and other practices such as water, sanitation and healthcare.

3. Continually monitor the approach, developments and impacts
   Key for this approach:
   - It is based on sound diagnostic research and incorporates strong scientific knowledge to develop solutions and continues with scientific backing in implementing and monitoring the solutions
   - It brings together health, education, livelihoods and food security in a new and powerful way.

How you can be involved
- Sponsor the whole program and be a global leader
- Partner in a village program
- Partner for a women’s self-help group
- Partner for a group of potential woman entrepreneurs to run a business (through training and providing assets)
Earlier only male farmers were given importance in agriculture, but now women work shoulder to shoulder with the men.

*Ms Muruahwari, Tamil Nadu*

The high yields and market value of chickpea last season meant I could buy a second pair of oxen.” She adds that she can now send all her six children to school. “I’m no longer seen as a poor widow but a successful farmer.

*Ms Temeghush Dabi, Ethiopia*

We have learnt to use degraded land.

*Ms Oumou, Head of Sadoré Women’s Group in Niger*

A first time entrepreneur, *Dibyaihothi Borgohain*, talks about the help she received from ICRISAT for her agribusiness start-up.

With guidance and technical support from AIP (ICRISAT) we created a product which we tested in schools, exhibitions and carnivals. It took us 8 months to work out a product. My partners and I are homemakers and first-time entrepreneurs. After managing our homes for years we felt we could manage anything! And we did it with ICRISAT’s support.

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BUILDING HEALTHIER COMMUNITIES – through sustainable solutions in agriculture

A more healthy and hence productive workforce
A happier and stronger community
New livelihood options opened

Problems
Worldwide 2-3% of GDP is lost as a result of malnutrition (World Bank)
Nearly 850 million people in the world are hungry and >2 billion are micronutrient deficient.
In India, 44% of children are malnourished – more than double that of sub-Saharan Africa. (UNICEF 2015)

A long lasting solution is to work with rural communities to grow and consume diverse, healthy foods.

The impact pathway for healthier communities through sustainable solutions in agriculture is:

1. Identify the major nutritional needs of the community
2. Analyze the agricultural options for growing foods that best help with the nutritional needs and match these with the consumer preferences
3. Undertake community driven approaches to achieve diversity on farm and appropriate agricultural practices
4. Build awareness and capacity on nutrition, health and good practices
5. Develop markets by linking farmers to value chains that offer traceability and confidence to consumers
6. Develop a buzz and excitement around nutritious foods.

1. Sustainable use of Natural Resources
2. Rejuvenating Degraded Landscapes
3. Waste Management - recycling and reuse
4. Building a business for Youth in agriculture
5. Empowering Women to drive the rural economy
6. Building Healthier Communities – through sustainable solutions in agriculture
7. Partner for Rural Village Growth
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9. Agribusiness Incubation building entrepreneurs
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11. Digital agriculture revolution
12. Farm Mechanization for enhancing farm efficiency and profitability
13. Discovery, conservation and use of Crop Genetic diversity
14. Join a CONSORTIUM to SCALE UP inclusive rural development and safeguard a sustainable environment
EQUINUT: a high-energy weapon fighting malnutrition

Malnutrition in Malian children is being tackled by a combination of improving a familiar traditional food recipe and eliminating toxin contamination from its main ingredient.

This increases the chances of the local forint food – Equinut – being acceptable and achieving its aim of reducing the high mortality rate in children under five years, while at the same time improving the child’s nutrition. Equinut can reduce malnutrition in children and could boost the use of locally available, nutritious produce. The improved yield can often work towards the potential for improved family food security by selling Equinut.

First 1,000 days are key

An integrated approach to improving nutrition is being tested in Mali, with initiatives working to improve health services, women’s groups and RICs. Training on nutrition and health includes breastfeeding, hygiene at the local health centres and infant and young child feeding.


"We need to take care of our babies even before they are born. It’s like when you want to have a good onion, you need to fertilise the soil so you can harvest the onion for a good yield," says Kayeste..


"We need to take care of our babies even before they are born. It’s like when you want to have a good onion, you need to fertilise the soil so you can harvest the onion for a good yield," says Kayeste. She uses a language that she knows her audience in rural Mali will understand.
UNLOCK the power of inclusive VALUE CHAINS for rural families

Develop new business areas

Provide livelihoods

Reduce poverty

Empower women through more opportunities

The Impact Pathway includes democratization of information so farmers can be full participants in equitable value chains and demand-driven innovation is applied to address gaps along the value chain:

Step 1) Review the value chain through the perspective of different stakeholders to identify gaps and opportunities.

Step 2) Use participatory approaches to develop strategies to work on the identified gaps and opportunities.

The approach is critical and includes:

- Building partnerships needed on-the-ground or at high-level government
- Establishing private public partnerships where needed
- Being community driven where on-farm solutions are needed
- Designing efforts to engage women and youth in the value chain and leadership
- Undertaking capacity building along the value chain – from building farmer knowledge to building entrepreneurial skills
- Continually monitoring progress, uptake and attitudes with regular feedback into the strategy
Exploring new products and global markets for sorghum

Specific products and markets were identified to capitalize on the domestic and international demand for sorghum and processed sorghum products. This included product-specific cultivars; products with good demand; and major export markets in Egypt, Saudi Arabia and SAARC countries.

The need for developing product-specific cultivars was highlighted by Dr A Ashok Kumar, Senior Scientist, Sorghum Breeding, ICRISAT. He cited examples of cultivars developed by Mahatma Phule Krishi Vidyapeeth, Rahuri – Phule Panchami for popping, Phule Uttara for papads (wafers) and Phule Madhur for hurda (fried immature grain).

Four products were identified for commercialization in domestic and export markets based on identified market demand: multigrain biscuits and cookies, sorghum flakes, seviyan (vermicelli) and pasta. Multigrain atta (flour) and pop sorghum were also identified as having a good market demand.

Initiatives prioritized for export promotion included the development of standards for various processed products; wet sampling and participation in international exhibitions; development of customized pre-processing machinery; and generating awareness on the nutrition benefits of sorghum.

These key points were discussed at a consultative meeting to fine-tune a strategy and develop a proposal to enhance the export marketability of sorghum and sorghum products from India. This proposal will be submitted to the Agricultural and Processed Food Products Export Development Authority (APEDA), Government of India.

"Global demand for nutritious food products paves the way for sorghum. The Sorghum Export Development Platform is a step in the right direction and we will fully support this endeavor that can benefit both entrepreneurs and farmers," said Mr Sunil Kumar, General Manager, APEDA.

A draft publication titled 'Enhancing Exports of Sorghum & Sorghum Products from India: Potential, Policy and Emerging Paradigms' was released at the meeting.

The meet was held at Pune, India, on 30 July as a follow-up to the first meeting organized on 17 March at ICRISAT. The meet was organized by Indian Institute of Millets Research (IIMR) in association with Department of Agriculture, Government of Maharashtra, and ICRISAT with funding support from APEDA.

An expert panel and over 50 participants from public and private organizations comprising exporters, experts from research and development organizations, government officials and representatives from the sorghum processing industry attended the meeting. For list of participants, see web edition.

For more on sorghum: http://exploreit.icrisat.org/page/sorghum/882
We see a huge need and value in fostering agribusiness entrepreneurship in developing countries. To take this even further we see an opportunity to provide the connections to local and global markets for these entrepreneurs.

This can be achieved by:
- Setting up agribusiness incubators in developing countries
- Linking these agribusiness incubators to provide access to the knowledge, connections and markets in other countries.

ICRISAT has already a proven model for establishing and managing an agribusiness incubator, and later expanding this by helping set up 22 agribusiness incubators in India and others in Malaysia, Philippines, Sri Lanka and throughout Africa.

This model requires initial support with the aim of being self-sustaining after 3-5 years. These self-sustaining incubators are set up through private-public partnerships.

You can:
- Sponsor the setting up of an agribusiness incubator
  This will include significant expansion of the number of incubators to reach a critical mass in Africa, Asia and Latin America.
  The incubators will be set up through private-public partnerships with ICRISAT mentoring the process of setting up and operating. You or your managers can also be involved in the mentorship of young entrepreneurs.
  The incubators nurture and mentor entrepreneurs, providing technical, business and market information, as well as knowledge on how to access credit and partners.

- Link these agribusiness incubators to provide access to the knowledge, connections and markets in other countries
  Linking the incubators across regions and countries will allow knowledge and technology sharing. This will be the channel for small agribusiness entrepreneurs to grow and tap other markets.
  Be a partner in expanding/strengthening this Global Agri-Business Incubator Network. This is a technology transfer model that allows two-way flow of knowledge and technologies, and will allow for faster scaling up and building of more profitable businesses.

ICRISAT has the experience of:
- Guiding the set up of 22 agribusiness incubators in India and 5 in Africa (Zambia, Kenya, Uganda, Ghana and Mali).
- Setting up the Network of Indian Agri-Business Incubators.
- Being a founding member of the Global Agri-Business Incubation Network and the African Agribusiness Incubation Network.
- Assisting and training in the set up of Food Processing business incubators in 5 African countries – Ghana, Mali, Uganda, Cameroon, Angola

Some impacts in India:
- Over 2,200 entrepreneurs supported/trained
- Over 9,000 people directly employed through incubators
- Over 1,200 ventures incubated and over 105 technologies commercialized
- Over 131,600 farmers directly benefited with value addition
- US$18 million: Investment mobilized for clients
- 832: Employment generated (direct) through clients
Gamma Agro Medical Processing (GAMP) has set up the first food irradiation process equipment that uses Gamma rays, in the Indian states of Telangana and Andhra Pradesh.


Some incubatees....

Gullapalli Renuka of Hyderabad Chocolates
Launched her business from home in 2012 and has now opened her first outlet at the Night Bazaar at Shilparamam in Hyderabad.


Agribusiness incubator for banana products in Uganda
A new African agribusiness incubator facility – Afri Banana Products Limited (ABP) – to promote young entrepreneurs in the banana value chain and other sub-sectors of agriculture was launched in Uganda.

http://www.icrisat.org/newsroom/latest-news/happenings/happenings1687.htm#2

Processed sorghum products developed by ICRISAT's Agribusiness and Innovation Platform.
Exploring new products and global markets for sorghum
Specific products and markets were identified to capitalize on the domestic and international demand for sorghum and processed sorghum products. This included product-specific cultivars; products with good demand; and major export markets in Egypt, Saudi Arabia and SAARC countries.

The need for developing product-specific cultivars was highlighted by Dr A Ashok Kumar, Senior Scientist, Sorghum Breeding, ICRISAT. He cited examples of cultivars developed by Mahatma Phule Krishi Vidyapeeth, Rahuri – Phule Panchami for popping, Phule Uttara for papads (wafers) and Phule Madhur for hurda (fried immature grain).

Four products were identified for commercialization in domestic and export markets based on identified market demand: multigrain biscuits and cookies, sorghum flakes, seviyan (vermicelli) and pasta. Multigrain atta (flour) and pop sorghum were also identified as having a good market demand.

Initiatives prioritized for export promotion included the development of standards for various processed products; wet sampling and participation in international exhibitions; development of customized pre-processing machinery; and generating awareness on the nutrition benefits of sorghum.

These key points were discussed at a consultative meeting to fine-tune a strategy and develop a proposal to enhance the export marketability of sorghum and sorghum products from India. This proposal will be submitted to the Agricultural and Processed Food Products Export Development Authority (APEDA), Government of India.

"Global demand for nutritious food products paves the way for sorghum. The Sorghum Export Development Platform is a step in the right direction and we will fully support this endeavor that can benefit both entrepreneurs and farmers," said Mr Sunil Kumar, General Manager, APEDA.

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**A movement for SMART FOODS**

These are foods that are:

**good for you** – nutrient-dense crops that are also...

**good for the environment**
– reduce the environmental footprint of agriculture by, eg, requiring less water and pesticides that in turn are...

**good for smallholder farmers**
– a traditional crop naturally resilient under climate change, with multiple uses and greater potential for development

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**Opportunities**

*If we want a strong healthy workforce in India now and in the future, we must overcome extreme malnutrition – Smart Foods are a key part of the solution.*

*If we want to cope with climate change we need to adapt our agriculture – Smart Foods are a part of the solution.*

*If we want to grow the economy we need to help underinvested and untapped markets – Smart Foods are a part of the solution.*

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**The impact pathway**

Millets (including sorghum) and legumes are Smart Foods and the focus of a campaign for India, Africa and globally. Millets will be the first step in the Smart Foods campaign, followed by legumes.
A Movement for SMART FOODS

The need for more nutritious and healthy foods
- Millets are high in protein, vitamins and micronutrients. Millets are 4 times higher in folic acid than rice, have low glycemic index and are gluten free.

The need for climate-smart crops
- That will survive climate change and use natural resources efficiently.
- Millets need less water than other cereals and are heat tolerant, e.g., pearl millet can survive in temperatures up to 64°C and requires less than 25% of the water required for rice.

The need for iron:
- In India, 52% of women, 80% of pregnant women and 74% of children under the age of 3 are anemic.
- Pearl millet has very high levels of iron that can meet the daily allowance of the average person.

The need for calcium:
- An estimated 25 million Indians are estimated to be affected with osteoporosis (Indian Journal of Medical Research). Calcium deficiencies contribute to osteoporosis, bone diseases and the underdevelopment of the fetus and young child.
- Finger millet has 3 times the amount of calcium than milk.

The need to help smallholder farmers
- Improve their livelihood options, achieve nutritional security, and manage the risk of extreme weather conditions can be addressed through Smart Foods.
- Millets still have significant potential for yield increases, multiple uses (from food, feed, fodder, fermentation and biofuels) and untapped markets.

Science with a human face

About ICRISAT: www.icrisat.org

ICRISAT’s scientific information: EXPLORE/it.icrisat.org

Joanna Kane-Potaka | Director, Strategic Marketing and Communication | j.kane-potaka@cgiar.org
Digital agriculture can revolutionize agriculture making it more profitable for the farmers through the democratization of information and access to appropriate inputs and equitable markets.

The greatest need is to deliver targeted and timely information to farmers based on their needs and aspirations. The empowerment that comes from providing farmers with informed options is transformational, especially for women and youth.

This can be achieved through:

### Bi-directional Information exchange

Inputs, weather, market prices and knowledge exchange between farmers is dynamic and with appropriate feedback loops, information and opportunities for farmers can be further refined to address the dynamic nature of agriculture production and market systems.

(ICRISAT is strong on partnerships and expertise to tap this information)

### Access to information and expertise

Direct to farmer, provide farmer to farmer learning, modernization of the extension system

(ICRISAT has set up models for private-public partnerships to ensure farmer access to information and knowledge services)

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**Technology**

Software, hardware, networks (ICRISAT has developed GIS based software and hardware like the KrishiPHABLET and KrishiSIM)

This can be set up on a small scale/area and also scaled up nationally.
Science with a human face

About ICRISAT:
www.icrisat.org

Joanna Kane-Potaka
Director, Strategic Marketing and Communication
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September 2015

ICRISAT Happenings

Informatio and Communication Technology tools to help women farmers

Three hundred indigenous farmers across 37 villages in India are to trial using phablets and mobile phones for the latest farming and marketing advice. This is part of a plan on a new business model for sharing information that is a win-win for all the players along the value chain.

ICRISAT's scientific information:
EXPLORE.it.icrisat.org

Asian Scientist

India farmers think big but grow micro to enrich their soil

Agriculture in India is taking a more productive and environment-friendly route with the help of micro-climate control systems.

BusinessLine

AP to support PPP model for farm sector growth

TVS Solar Systems Ltd. has signed an agreement with the AP government under the PPP model to develop micro-irrigation systems in the state.

ICRISAT Happenings

Digital agriculture initiatives to boost smallholder agriculture

A partnership with the Indian Agricultural Research Institute (IARI) and the University of Agricultural Sciences, Bangalore, will look at integrating satellite and ground-based technologies for enhancing crop productivity in rainfed environments.

Kriti Vani

The Kriti Vani platform was initiated in collaboration with the CPCFC in Karanataka to benefit 45,000 farmers. The platform helps farmers to access information on crop health and weather conditions.

Joanna Kane-Potaka | Director, Strategic Marketing and Communication | j.kane-potaka@cgiar.org
FARM MECHANIZATION
for Enhancing Farm Efficiency and Profitability

More profitable agriculture
Better livelihoods and reduced poverty
Global competitiveness

Why mechanization in agriculture?

- Enhancing efficiency of smallholder farmers who are affected by increasing labor costs is needed to make agriculture more profitable
- Declining availability of animal power for agriculture
- Modernizing agriculture will attract youth back to agriculture
- Farm mechanization reduces crop production costs and post-harvest losses, and boosts crop output and farm income.

How it can be implemented?

- Build public private partnership to promote mechanization of small farms
- Incentivize small farm holders to adopt mechanization
- Establish custom hiring centers to enable small farm holders to adopt mechanization for increasing agricultural productivity
- Promote farm mechanization among stakeholders by way of on-field and off-field training and demonstrations.
- Develop and popularize models of science-led efficient agriculture through mechanization
- Enable policies and institutions to promote modernization of agriculture and mechanization.

What has been implemented?

- There has been a steady shift from animal power to electro-mechanical sources of power in some central and southern states – Maharashtra, Andhra Pradesh, Telangana, Karnataka, Madhya Pradesh, etc
- Researchers have developed direct seeded rice to cope with the growing water scarcity
- Minimum tillage promoted as a conservation farming technique for sustainable development
- Farm mechanization is promoted in pilot sites of BhooSamrudhi in partnership with Government of Karnataka as well as Rythu Kosam with Government of Andhra Pradesh.
Bullock operated Tropicultor.

Tractor operated Broad Bed Furrow machine.

September 2015

Joanna Kane-Potaka | Director, Strategic Marketing and Communication | j.kane-potaka@cgiar.org
Recent advances in genomics and molecular breeding technologies provide new opportunities to accelerate and advance the breeding of crops.

The new technologies can provide faster, cheaper and reliable genotyping and phenotyping data and ultimately new crop varieties that are high yielding and biofortified, leading to better nutrition, better resistance to pests and diseases and greater ability to cope with climate change.

Impact pathway

1. Genebank operations – long-term conservation of genetic material
2. Characterizing genetic diversity in the genebanks by evaluating entries under specific stresses
3. Identifying traits developed by farmers – to help deal with climate change and increase nutritional quality and profitability
4. Using this genetic diversity to accelerate the development of nutritious varieties using advanced genomic technologies and bioinformatics
Genomics of plant genetic resources for global food security

The world's population is projected to reach 10 billion by the year 2050, which will require a 70-100% increase in food production amid the effects of climate change that threaten food security across the globe. New scientific tools like genomics of plant genetic resources are the world’s best option to meet the food production requirement in the next 40 years.

With the rapid advancement of genomics research, gene sequences should be available hopefully in the next 3-4 years for all plant species of economic importance. But the most important challenge to the scientific community will be to utilize these gene sequences and genome sequence diversity for crop improvement for food security, as well as for conserving biodiversity, emphasized Dr Lll Gowda, Program Director - Grain Legumes, in the inaugural address he delivered on behalf of Director General William D. Dar at the 3rd International Symposium on Genomics of Plant Genetic Resources (GPGR3).

Tackling the challenges of addressing global food security today and in the future, GPGR3 is being held this week, 16-19 April, in Jeju Island, South Korea.

ICRISAT, in the last two years, has led a global research team in completing the genome sequencing of chickpea and pigeonpea, two important legume crops and major protein sources of the poor in the dryland tropics. "By the end of 2014, we should have

Intensifying genome sequencing work for drought proofing crops in Karnataka, India

The Government of Karnataka, India, has requested ICRISAT to lead the coordination of the state government’s initiative on sequencing and molecular breeding of finger millet.

ICRISAT’s experience on coordinating complex genome sequencing projects with targeted product delivery was shared with the Karnataka state Agriculture Minister, Mr. Krishna Byre Gowda, and other senior government officials at a recent meeting “Decoding genome sequence for strengthening the genetic improvement of finger millet”.

Dr Rajeev K Varshney, Research Program Director-Grain Legumes, ICRISAT briefed the participants on the genome sequencing-related activities at ICRISAT. Further discussions involving sorghum and pigeonpea improvement for Karnataka state were also held.

ICRISAT’s Dr Santosh Dashpande and Ruchit Saxena, provided an overview of ICRISAT’s activities on sorghum and pigeonpea improvement. The officials suggested developing molecular breeding projects in partnership with concerned Karnataka State Agricultural Universities.

Activities for all crops will be part of an existing MOU between ICRISAT and Karnataka on drought proofing crops. The meeting was held in Bangalore on 18 July.

Using new genomics tools for sorghum improvement

New genomics tools can address urgent needs for a more drought resilient food supply, increase rates of sorghum improvement to better meet long-term population growth, and investigate production systems that promote sustainable farming, particularly regarding preservation and/or restoration of soil resources and water quality.

This is the aim of the project Feed the Future Innovation Lab for Climate Resilient Sorghum. The project is an international initiative led by University of Georgia’s Plant Genome Mapping Laboratory and involving partners from USA, South Africa, Ethiopia, Mali and ICRISAT. The project is funded by the United States Agency for International Development (USAID).

The project launch and first-year review meeting was held in Addis Ababa, Ethiopia recently. “We have spent over 20 years building genomic tools and fundamental knowledge of sorghum and this is an exciting opportunity to put all this research to work, especially for the region from where sorghum has originated,” said Regents Professor Andrew Paterson, project lead, University of Georgia (UGA).

Dr Stefania Grando, Research Program Director, Dryland Cereals, ICRISAT stressed on the importance of the project for the program and its further linkages & integration to research activities across regions within CGIAR Research program on Dryland Cereals.

The project partners presented progress for their respective activities under two major goals: improving sorghum’s drought and heat tolerance, and improving rotational ability in sorghum. The independent technical advisors to the project: Prof. Samuel Gadau (Rongo University, Kenya), Dr Frew Mekbib (Haramaya University, Ethiopia) and Dr Abdale A Mohamed (Senior Sorghum Breeder, ICRISAT- Ethiopia), gave suggestions for further strengthening activities for second year.
Inclusive rural development and sustainable environment are a must

Sustainable and efficient use of scarce water and other resources

Create economic opportunity for women and youth in rural areas

More profitable agriculture through equitable markets

At a scale with more impact

With one rural development initiative in a village or region, 100s of families can benefit and 1,000s of hectares of natural resources can be sustainably managed.

However – through a consortium to scale up this work we all can make a bigger impact on millions of lives and hectares.

◆ A platform to learn from each other ◆ Contribute different skills

◆ Reach a critical mass ◆ Provide a more holistic approach to development

The pathway to impact:

1. Identify areas of common interest, by:
   ◆ overall goals ◆ type of innovations ◆ geographic areas

2. Identify possible contributions, by:
   ◆ expertise ◆ activities ◆ infrastructure ◆ resources ◆ partnerships

3. Select common initiative

4. Develop impact pathway – including targets, roles, implementation plan, monitoring and evaluation, and costs and benefits

5. Review 6-monthly and adjust accordingly

The approach:

* Building partnerships for development

* Science-backed interventions

* Monitoring and evaluation undertaken in real time

* Regular feedback and sharing of lessons learnt
The Bhoochetana initiative in 3 years reached

3 million farmers
3.7 million ha

Farmers made up to $500 net gain per ha in one season

20-66% yield increase
5% rise in agriculture growth
$1 invested = $3-14 return

Science with a human face

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June 2016