

The IFAD-EU NUS Project in India

Promoting kodo (*Paspalum scrobiculatum*), kutki (*Panicum sumatrense*) and other nutritious underutilized species in Mandla and Dindori districts, Madhya Pradesh

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Introduction

The Project 'Linking agrobiodiversity value chains, climate adaptation and nutrition: Empowering the poor to manage risk' will be implemented in India by Action for Social Advancement (ASA). This NGO was involved in the previous phase of this initiative^{††} (2011-2015), in which they worked with farmers in Mandla and Dindori districts of Madhya Pradesh to strengthen on-farm conservation for better climate resilience. This phase of the initiative will build on these efforts and other work by ASA to enhance soil quality, water resources development for minor irrigation, forward and backward linkages of farmers with the market for agri-business, credit, insurance and other services, etc. to enhance income, livelihood resilience and nutrition of farmers in the region.

Context

India is host to a large share of the world's malnourished people: 60 million in the country are undernourished and 9 million suffer from severe acute malnutrition. In Madhya Pradesh, nutritional status is below the country average as 60% of children under 5 years of age are underweight in the State as compared to 43% at country-level (IIPS & Macro International 2007). Infant mortality and nutritional status of children are critical in Mandla and Dindori districts, where the rate of underweight is 56.5-61.7% (Brahmam et al. 2011ab). There are many factors contributing to under-nutrition in India. A leading issue is the nutritional status of women during adolescence, pre-conception and pregnancy. Poor infant and young child feeding practices and poor intake of essential calories, proteins, fats, micronutrients and vitamins (especially vitamin A) are also important factors (IIPS & Macro International 2007, IIPS 2010).

Madhya Pradesh is a strongly indigenous state, with more than 20% of households identified as 'scheduled tribes' in the National Census (2001). The districts of Mandla and Dindori are predominantly inhabited (~60%) by indigenous peoples, including Gond, Baiga, Dhoba and Ahir. The Baiga, found especially in Dindori district are recognized as 'Particularly Vulnerable Tribal Groups' by the Indian government (Ministry of Tribal Affairs).

Agriculture is the major livelihood source in Madhya Pradesh. Mandla and Dindori districts are characterized by subsistence production, with nearly one third of farmers considered small or marginal. Collection of non-timber forest products is another important livelihood source in the district, while the livestock sector and small-scale enterprise/service sector are also important. Seasonal migration is common in the region. Major constraints to the farmers in the area include climate and soil issues, as well as poor availability of capital, dependency on wage labour, disorganization, primitive agronomic practices and poor access to government sponsored schemes.

Almost 70% of the crops in Madhya Pradesh are rainfed. In Mandla and Dindori, only 6-10% of crops are irrigated. Rainfall is highly seasonal, occurring from June to September with the number of rainy days ranging from 70 to 80 days and an average total rainfall of 1250 mm. The rains feed

^{††} The project 'Reinforcing the resilience of poor rural communities in the face of food insecurity, poverty and climate change through on-farm conservation of local agrobiodiversity' was supported by IFAD from 2011-2015.

many perennial/seasonal water bodies in the Dindori and Mandla area, including the Narmada, Johila and Son rivers. The dependence of rain water makes the agriculture in this region highly vulnerable to climate change. Rising temperatures, declining rainfall, reduced irrigation potential, extreme climatic events, and increased pest and disease pressure are being experienced already and will affect the region already suffering from malnutrition. From the end of the century, temperature increases are predicted to reduce rice yields in India (Burney & Ramanathan 2013).

Madhya Pradesh has very rich agricultural biodiversity that stems from its geographic diversity, including 12 agro-climatic zones, 6 crop zones and 26 prominent soil types. The diversified topography and variable climatic conditions provide the basis for a rich biodiversity and indigenous knowledge. Mandla and Dindori districts form a contiguous terrain and ecozone with consistent forest cover, situated in one of 22 Biodiversity Hotspot of India known as the “Malwa Plateau and Central Highlands”. The major crops cultivated in Madhya Pradesh include cereals (paddy, maize, wheat and sorghum) and legumes (chickpea, pigeon pea, lentil, peas, soybean, and groundnut). Other major cultivations are cotton, linseed, mustard, sugarcane and niger. Neglected and underutilized species cultivated in Madhya Pradesh include minor (small) millets, colocynth (*Citrullus colocynthis*), chhota bargad (*Ficus cutulata*), sickle pod (*Cassia tora*) and hairy senna (*Cassia hirsuta*). Other underutilized species of India are shown in Box 1.

The major crops in Mandla and Dindori are similar to the State-level, with some distinctions. In the *rabi* (winter) season, wheat, chickpea, lentil, peas, linseed, mustard and niger are grown. In *kharif* (monsoon) season, paddy (including many indigenous varieties), maize, blackgram, and pigeon pea are the major cultivations. Minor millets are cultivated on dry lands which are not suitable for the major crops, with the most popular being kodo (*Paspalum scrobiculatum*) and kutki (syn. little millet *Panicum sumatrense*), and to a lesser degree finger millet (*Eleusine coracana*). Madhya Pradesh is one of the few regions of India where kodo millet is cultivated, with some cultivations also in Tamil Nadu.

Box 1. Some neglected and underutilized species apart from millets in India. Source: Bhag Mal (2007).

Pulses

Dolichos uniflorus (horse gram), *Psophocarpus tetragonolobus* (winged bean), *Vigna aconitifolia* (mat bean), *V. umbellata* (ricebean)

Oilseeds

Amoora rohituka (pithraj Tree), *Azadirachta indica* (neem), *Aesandra butyracea* (Indian butter tree), *Calophyllum nophyllum* (Alexandrian laurel)

Vegetables

Amaranthus polygonoides (tropical amaranth), *Bambusa tulda* (spineless Indian bamboo), *Bambusa spinose* (kauayan), *Bambusa vulgaris* (common bamboo)

Fruits

Aegle marmelos (bael), *Artocarpus lakoocha* (monkey fruit), *Carissa congesta* (conkerberry), *Embllica officinalis* (Indian gooseberry)

Spices and condiments

Amomum aromaticum (Bengal cardamom), *Amomum xanthioides* (false cardamom), *Anethum sowa* (Dill), *Areca triandra* (Triandra palm)

Target Crops

Minor millets are traditional crops in Madhya Pradesh but their production area has declined more than 50% in the last 20 years (Jain & Singh 2008-2010; FAOSTAT). Preliminary research has found that the kodo varieties currently grown in Mandla and Dindori are improved varieties developed by researchers, but four landraces used to be cultivated in the region. Six landraces of kutki have been preserved by indigenous farmers in the region but the scented *Jawaphul* variety is believed to be extinct. Before 1978 there were 6 landraces of finger millet of which only two are now left. Four landraces of foxtail and two landraces of barnyard millet are maintained by the farmers in

Mandla and Dindori but these crops are grown only sparingly. Pearl millet and sorghum have almost disappeared from the area.

Minor millets are generally suitable for dry and marginal lands, requiring less water and maturing early. Kodo millet in particular is among the most drought-tolerant of the minor millets, meaning it has strong potential to support climate adaptation of rainfed farming systems. The minor millets also have strong nutritional value compared to the more common cereals like rice. Indeed these crops are appreciated for high fibre content, protein quality, mineral composition, and nutraceutical values. Kodo millet especially stands out for its iron content (Table 1). Millets are also useful for diabetic patients because of their low glycaemic index. Because of their accessibility to the poor, minor millets can play an essential role in providing nourishment to people across all income categories, especially pregnant women, lactating mothers, and children.

The value of millets has been increasing on the market in recent years. Millets were also recently included in the Public Distribution System (PDS) of India with the National Food Security Act (2013), in which they are referred to as 'coarse cereals'. Procurement and sale of millets through the PDS programmes in most State has not yet started but the policy development is opening up opportunities for millets to make a stronger contribution to household income and food and nutrition security.

Minor millets, particularly kodo and kutki, will be the primary focus of the Project in India. Cultivation and consumption of these crops will be promoted to benefit climate resilience, nutrition, food security and income of the target communities. Increasing the use of these climate-hardy crops can strengthen food security by ensuring greater availability of food, especially in drought years. The nutritious properties of millets can also enhance diet quality. It is acknowledged that millets cannot provide all the essential nutrients for a balanced diet. Promoting nutrient-dense foods such as vegetables, fruits, pulses and animal source foods would also be strategic to address malnutrition in the target sites.

There are many neglected and underutilized fruit and vegetable species grown and gathered by the communities in the target area, including moringa (*Moringa oleifera*), taro (*Colocasia esculenta*), and amaranth (*Amaranthus* sp.). These will be documented early in the Project to identify species with high potential to improve nutrition, income and climate resilience of target communities.

Table 1. Nutrient composition of millets vs fine cereals. Source: Gopalan, Rama Sastri & Balasubramanian (1996).

Grains	Nutrient per kilogram (all values for 1000 gms)									
	Protein (g)	Minerals (g)	Fibre (g)	C (mg)	Ph (mg)	Fe (mg)	B-car (µg)	Thiamine (mg)	Riboflavin (mg)	Folic acid (µg)
Sorghum	104	16	16	250	2200	41	470	3.7	1.3	200
Pearl millet	116	23	12	420	2960	80	1320	3.3	2.5	455
Italian millet	123	33	80	310	2900	28	320	4.7	2	150
Finger millet	73	27	36	3440	2830	39	420	4.2	1.9	183
Little millet	125	19	22	140	2060	8	0	2	1.8	-
Kodo millet	77	15	76	170	2200	93	0	3	0.9	90
Rice*	64	7	2	90	1430	10	-	2.1	0.5	110
Wheat**	118	15	12	410	3060	53	640	4.5	1.7	366

* Parboiled and milled

** Whole

Target Sites

The Project is focused on Mandla and Dindori in Madhya Pradesh (Figure 1). 30 villages are being targeted by the Project, which include 4,518 households. These villages are listed in Table 2 and a map of the targeted villages is shown in Figure 2, also showing the other villages that ASA works with in the region. The knowledge and data from those villages will be used to establish a context analysis and counterfactual.

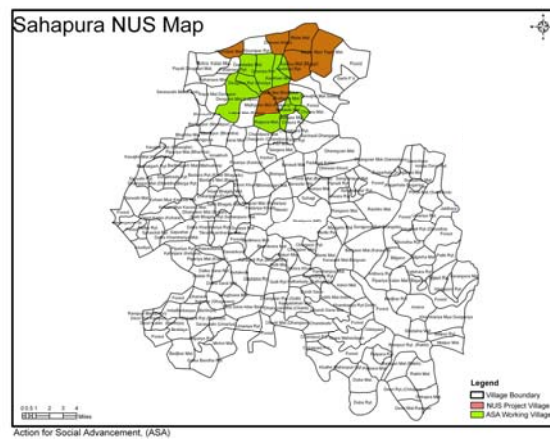
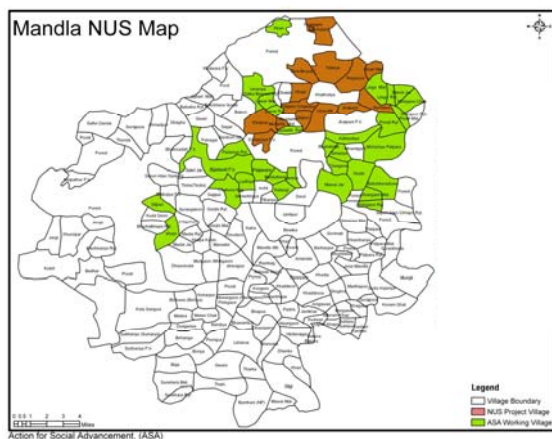
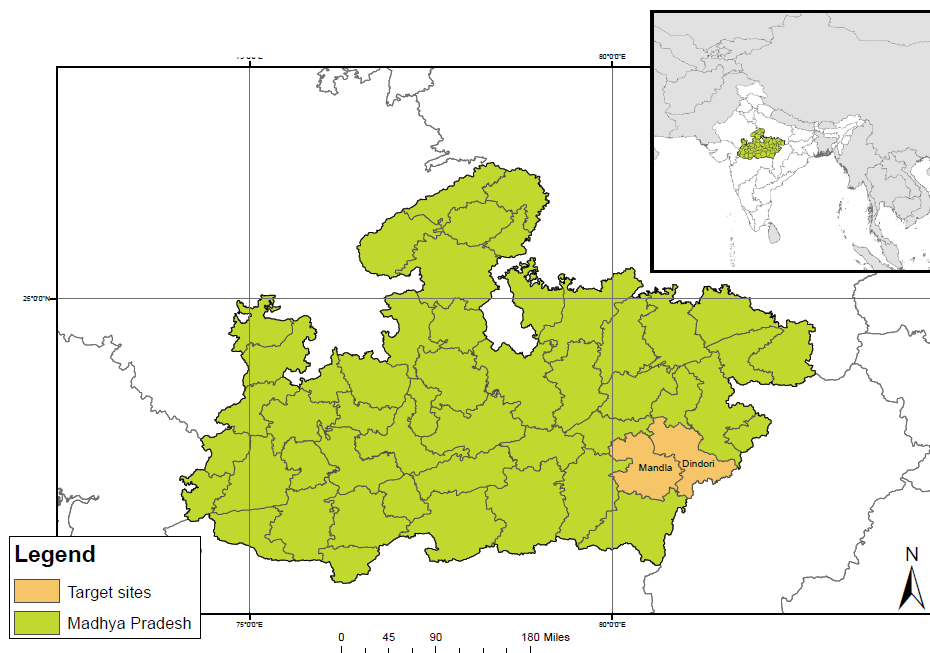


Figure 1. Target districts of the Project in Madhya Pradesh: Mandla and Dindori (Top). Villages targeted in each district are indicated in red, with other working villages of ASA indicated in green (Bottom).

Table 2. Villages targeted by the IFAD-EU NUS Project in India in Mandla and Dindori Districts

Village	Total Households	Village	Total Households
<i>Mandla District</i>		<i>Dindori District</i>	
Singarpur	115	Magar Tagar	257
Salaiya	104	Salaiya	295
Khiri Mal	123	Bhelai	230
Kodopani	242	Khursipar	149
Tikraberpani	73	Dhiravan	262
Piperpani	87	Majgaon	91
Khari	90	Dobhi	143
Hardua	148	Chanta Mal	234
Jhalpani	75	Chirpoti Mal	148
Silpuri	124	Bagli	115
Umardeah	166	Barrai	345
Patparsingarpur	168	Khamariya	87
Muddeah	121	Devragarh	192
Khuksar	121	Parapani	167
Dungaria	46	Kathotiya	663

Major Project Activities

Low productivity, poor seed availability, weak market opportunity and low price are major constraints for farmers to continue cultivating minor millets. These crops have been relegated to less fertile areas of farmers' land, resulting in lower yields and their further marginalization in the family food basket and national economy. Through the Project, ASA aims to improve productivity and remuneration from millets cultivation to enhance their production and supply.

A holistic approach will be used for the value chain development of minor millets that will give attention to production-supply issues and market-demand issues to achieve livelihood and sustainability benefits. A participatory, pro-poor, gender sensitive approach will be followed to support the empowerment of vulnerable groups through strengthened use and conservation of their traditional crops. Multi-stakeholder platforms will be held early in the Project to analyse constraints to millet cultivation, marketability and consumption and foster productive collaboration and collective action to organize and upgrade the value chain.

High Quality Seed

Identification of high quality varieties of kodo and kutki through participatory variety selection will be a major action to raise their productivity. Abandonment of millet production has been associated with erosion of genetic diversity in the area. New varieties will be introduced from other areas of India and from genebank and research organization collections, which will be evaluated alongside the locally available varieties. Identification of preferred varieties that are well-suited to the local environmental and cultural conditions will support adaptation of the farming systems to climate change, as selected varieties may be shorter duration or more tolerant of drought, pests, disease or other pressures faced by the communities. Preferred varieties will be produced at a large scale and commercialized through farmer producer companies, making quality seed more available in the target area, which should help raise productivity and the contribution of millets to family food security and income.

Training on Farm Practices

Productivity of millet will also be improved through training on good agricultural practices for cultivation. ASA has developed a package of practices inclusive of good agricultural practices, responsible environmental and social practices for farming. All these together the package of practices is called the 'responsible crop initiative'. Besides internal evaluations done time to time during the season, the protocol involves a third party verification of compliances by the farmers. Additional farm practices will be promoted to support coping and adapting to climate change conditions. Practices to be covered include intercropping, integrated pest management, production and use of organic fertilizers, rain water management, etc. Weather data will also be made available to the farmers to help guide their planting decisions.

Farmers' field schools, farmer field trial, farmers' field days, mobile-based communication, etc., will be used to train farmers on the package of practices. Particular emphasis will be given to the women farmers who are actively engaged in farming but have very little recognition as farmers and the new skills and training are seldom imparted to them.

Collective Marketing

Minor millets are currently marginal on the market in India due in part to inconsistency in quantity and quality of production. Collective action and institution building are necessary to help farmers achieve scale in millet production.

ASA has already established over 200 self-help groups with majority women members in the target villages who will be the main entry point for the implementation of Project activities. Three farmer producer companies have also been established in the target area since 2013 (with a fourth currently being formed) that will be involved in millet commercialization (Table 3). The shareholders in these companies are members of the self-help groups and all profits are being distributed among them. The farmer producer companies have store-fronts, warehouse facilities, etc. already

established which will be leveraged for kodo and kutki millet commercialization. With the support of the Project they will enhance their warehouse capacity, introduce intermediary processing machinery (graders), and make efforts to scale up their business for kodo, kutki millet.

Table 3. Farmer producer companies and self-help groups

District	Name of Farmer Producer Company	# Shareholders
Mandla	Mandla Tribal Farmer Producer Company	1060
Mandla	Mahesh Mati Tribal Farmer Producer Company	640
Dindori	Dindori Keshan Producer Company	1020

In the first year of the Project, plans are to organize the aggregation of millet production to achieve a large quantity that can be sold at a higher price for farmers by reducing the number of middle men between the farmers and bulk buyers. Novel market information systems, including the National Commodities Exchange (NCDEX), Indian Farmers Fertilisers Cooperative Limited (IFFCO), Sanchar and other platforms, will be leveraged to increase farmers' awareness of market opportunities and help them secure the best possible prices. The IFFCO system will relay to farmers information regarding millet price in the three major markets (*mandi*), monitored by the ASA team, along with weather information via daily SMS messages. The NCDEX web platform connects sellers and buyers from throughout India and will be investigated as a means of securing a higher price for bulk sale of millets from the producer companies.

The income benefits of value-addition (e.g. product development), as well as restaurants and eco-tourism will be explored. Synergies with IFAD's Tejaswini Rural Women Empowerment Programme, which has established millet-producing self-help groups in several districts in Madhya Pradesh, including Mandla and Dindori, will also be explored. The identified varieties by our Project could be highly relevant for enhancing productivity in the area, including villages involved in the Tejaswini Programme. Furthermore there is the prospect to collaborate for collective marketing or linking our producers as suppliers for value addition work carried out in Tejaswini communities and training programmes related to best practices for millet cultivated, marketing, conservation and culinary preparation.

Consumption

Beyond increasing productivity and profitability of millets, interest among consumers is also a major constraint in upscaling millets. Activities to raise awareness will be undertaken in the Project to increase interest in millet consumption among rural communities and urban consumers. Millet promotion over the next three years will involve schools and village exhibitions, national and international fora, food fairs and other forms of communication. Seed and food fairs will be organized to promote awareness of the values and tastiness of millet-based foods, as well as to encourage seed exchange. A three-day Tribal Farmers' Food Festival will be organized in Bhopal in January 2016 with special focus to millet crops. Self-help groups will be sensitized on the role of millets and other local crops in balanced diets, taking the results of baseline investigations of diet diversity into account. Nutrition training will be also be one area of complementarity explored with the Tejaswini Rural Women Empowerment Programme

Conservation

Sustainable agricultural value chains and production systems depend on availability of quality genetic resources and seed. Actions will be taken in the Project to conserve the genetic diversity of minor millets to ensure continued availability and adaptability of materials in a changing climate.

Custodian farmers will be identified, recognized by their communities for exceptional knowledge on local agricultural biodiversity and as reliable seed keepers and seed sources. Networking and capacity building of custodian farmers will be promoted through exposure visits to the genebank in Raipur University and community seedbanks in other regions of India.

Documentation and monitoring of local agricultural biodiversity will be promoted by mobilizing village-level Biodiversity Management Committees and People's Bioersity Registers in accordance with the regulation of India's 2002 Biodiversity Act and the National Biodiversity Authority. The format promoted by the Madhya Pradesh Biodiversity Board will be adopted and adapted to include neglected and underutilized species (crops and non-timber forest products). Surveying in the Project will also lead to preparation of a red list of threatened crops and varieties for which conservation action will be taken.

Lobbying for Supportive Policies

Policies can be key in realizing or hindering the benefits of minor millets for nutrition, income and climate resilience. A policy analysis group will be established with qualified professionals to analyse key policy issues and make recommendations for policy changes and implementation strategies that can help realize the livelihood and sustainability benefits of millets. Key areas of focus will be seed legislations, intellectual property rights and integration of *ex situ* and *in situ* conservation methods. Other key programs of focus will be the PDS, mid-day meal schemes, Nutricereal and Nutrifarm schemes in Madhya Pradesh and the National Food Security Mission (NFSM)^{##}.

Acknowledgements

This paper was compiled based on the presentations and discussions in the National Stakeholder meeting in Bhopal, India 19-20 June 2015. Gaia Gullota assisted in assembling key facts and produced the map of target districts. Information presented by O. P. Dubey, Saikat Datta Mazumdar, B. Dayakar Rao, Elizabeth Thomas, O. P. Agrawal, M. K. Chartuvedi, and E.D.I. Oliver King provided key facts used in the introductory paragraphs. Plans for the Project were proposed by the authors and refined through discussion with the stakeholders at the meeting (Appendix VI).

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^{##} Previously Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP).