Role of local biodiversity resource & traditional knowledge wisdom to enhance the productivity of fields & Seed diversity for sustainable food & nutrition sovereignty

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"When diet is wrong, medicine is of no use.When diet is correct, medicine is of no need."-Ancient Ayurvedic Proverb

Our Food system is based on (with Science & Traditional knowledge wisdom)

- Rich diversity of nutritive food ingredients
- Climatic changes & Ritucharya
- Seasonal changes
- Natural changes of body
- Biological needs of body

The basic principles of our Food system

- Rich diversity of food ingredients (flora & fauna) in food
- Food resource from healthy ecosystems (healthy soil, water, natural)
- It attaches an attention to the effect of the cooking method on the quality of the foods, the importance of the vibrations of the cook and of the surrounding atmosphere, the compatibility of foods, the right time for cooking and eating, seasonal cycles and the effects of food on consciousness.
- The five Elements, the three Doshas, the three Gunas, the seven Dathus and the six Tastes.

Major food supplying resources

- Forest
- Corridors between forest and villages
- Wilderness areas around villages / Village outskirts
- Agriculture fields
- Fences of agriculture fields
- Common property resources (pastures, river banks, rivers, hillocks, sea shores, sea, lakes, fallow lands, 'waste' lands, etc.)

Resource Area	Flora	Fauna Sp.	Plants used by local community			
	Sp.		Wild Edible	Medicine	NTFP	Fodder
Agriculture fields (Chhogala, Gunja, Mavli, Kada, Kheralu, Jhadol, Dungarpur, Visnagar, Nakalank, Kanthariya, Ghaghret, Kalpavalli	91	>140	104	67	3	41
Fences of agriculture fields (Chhogala, Gunja, Mavli, Kada, Kheralu, Visnagar, Jhadol, Upli Sigri, Undarada	189	>90	62	76	31	32
Forest (Jessore WLS, Balaram WLS, Polo, Kawant, Naswadi, Taranga, Kalpavalli, Kuvarsi-Danta, Shamlaji-Sabarkantha, Pavagadh, Sitamata & Mount AbuWLS	972	>735	398	438	127	94
Corridors between forest & villages (Balaram WLS, Chitrasani-Palanpur, Zer Dhareshwar-Vijaynagar, Undapani- Bhiloda, Devas, Pachmadhi	476	>570	194	297	98	58
Wilderness / Village outskirts (Vadnagar, Ishwariya, Lakhabaval, Gunja, Jhadol, Gogunda, Valam, Udalpur, Valasana, Vadgam, Thalota, Mandropur, Nakalank, Mushtikovila)	269	>300	137	174	53	49

Resource Area	Flora Sp.	Fauna Sp.	Plants used by local community			
			Wild Edible Plants	Medicine	NTFP	Fodder
Common property resources						
Pastures (Kachchh, Tharad, Idar, Kalpavalli)	268	>180	79	163	41	52
River banks, rivers, lakes (Narmada circumambulation, Tapi, Banas, Jaisamand	329	>400	91	168	82	71
Sea shores, Sea (Jamnagar, Chorwad, Kodinar, Pirotan Island, Navinal Island, Nana Layja, Mota Layja, Okha, Surat, Shravan Kavadiya,)	>294	>300	81	74	42	48
Hillocks (Taranga, Southern Aravallis- Rajasthan, Jhadol, Pavagadh, Shoolpaneshwar, Kalpavalli)	>349	>200	160	127	72	48
Waste lands (North Gujarat, Vadodara, Saurashtra,)	192	>200	76	71	37	69
Total	1087	>900	387	483	241	167

- Between 30% & 50% or 1.2-2 bn tones of food produced around the world never makes it on to a plate (Murdo Macleod for the Guardian).
- As much as half of all the food produced in the world- equivalent to 2 bn tones- ends up as 'Waste' every year.
- Globally, an estimated more than 1.02 billion people are undernourished (FAO 2009). The literature on vulnerability, food security and ecosystem services has tended to emphasize cultivated foods (MEA 2005; Ericksen et al. 2009).
- Over 50 per cent of the world's daily requirement of proteins and calories comes from three crops—Wheat, Maize and Rice (Jaenicke & Hoschle-Zeledon 2006); 12 species contribute 80 per cent of total dietary intake.

Strong contribution of

Biodiversity in

Food & Nutrition Security

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Millets help in BD conservation; Birds, small animal associations



Echinochloa frumentacea (Bati)





Eleusine coracana (Maal)

Hybrids affected honey Bee population; butterflies, dragonflies, damshelflies, etc.

GHOOGHARI:

an ideal traditional breakfast

Sprouted grains + seeds of Millets + Pulses + Sahajan

CHATPATI GHOOGHARI



MITHI GHOOGHARI











Millet diversity register: mapping of Millet areas in Gujarat & Rajasthan; millets can support Agro-forestry system in mountain ecosystem, can enhance food-fodder-nutrition security











t+k;dk taxy dk

Forest Plants under edible use

Moringa oleifera Lam. Saragavo, Sahajan, Sargu, Senjana, Moringa tree



Moringa : The Miracle Tree

Emblica officinalis Gaertn. Aamala, Anwala

Fruits are sour, astringent, bitter, acrid, sweet, cooling, anodyne, ophthalmic, digestive, carminative, stomachic, laxative, aphrodisiac, rejuvenative, diuretic, tonic

Cassia fistula Garmalo, Karmela, Amaltas

Madhuca indica J.F. Gmel Mahudo, Mahua

Flowers are rich source of Sugar, Protein, Vitamins & Minerals

Rivea hypocrateriformis Fangvel

Analgesic, Anti-inflammatory

Aloe barbadensis Mill. Kunvarpatha, Gwarpatha

Blood purifier, Good for skin, Good for overall health

Madhunashini, Gudmar, Gymnema sylvestre R. Br.

Digestive, Anti-inflammatory, diuretic, hypoglycemic (medicine to treat diabetes)

Ceropegia bulbosa in wild

Ceropegia bulbosa, a twiner with underground bulb - The entire plant along with bulb, branches, leaves, flowers, fruits and buds is used for edible purpose. Highly nutritive, energetic

Woman selling Nymphaea pubescens fruits in local market

A local sweet dish '*Khir*' is made up of seeds of *Nymphaea pubescens* ('Ghiya', the seeds smell like- '*Ghee*') & *Ocimum americanum* (*Tukmariya*) occasionally and during fasting days.

Hibiscus rosa sinensis Linn.

Jasud, Gudhel, Jasvanti

Flowers: Refrigerant" emollient, emmenagogue, Aphrodisia

Opuntia elatior Thor, Fafdathor, Hathlothor, Naagfani

Plant parts dried and preserved for the off-season consumption

Pods of *Cyamopsis tetragonoloba*

Infloresence of Cordia gharaf

Prosopis cineraria (Sangari) Capparis decidua (Kair)

Famine Foods

Capparis decidua, locally known as 'Mani' **Eragrostis ciliaris** (Chinchani)

Traditional Pickles

Capparis cartilaginea habitat specific sp., grows in cliffs, status- Rare. the most important species in pickle making. Aerial parts (tender twigs) along with leaves and fruits are used.

Daily consumption is believed to help in curing Arthritis

Pods of *Cassia fistula* (*Garmal*) boiled and used in pickle making after removing the upper coat.

fishermen and camel herders (locally known as *Maldhari*) graze their camels in mangrove habitat, use seeds of *Avicennia marina* to make pickle.

Food Festivals, campaigns, workshops

- Millets and Wild edibles (including edible weeds): the total package of nutrition
- Wild edible plants for food & nutrition security: why hunger burden on Agri fields.
- Ayurved and traditional foods: Food and health security
- Delicious Medicinal plants recipes: we don't need doctor
- Natural Food heritage
- Wild cuisine
- Hamare bhule bisre vyanjan
- Wild delicacies, Healthy drinks: sustainable health is in our hands
- Slow Foods , healthy fields, healthy life...
- Our Festivals & related traditional foods : A scientific food system of India
- Recipes for health: solution of malnutrition, Diabetes, constipation, etc.
- Sahi Ritucharya aur Sahi Bhojan : Utkrusht Jivan hetu
- Common Property Resources for food & Nutrition security
- Ancient Aahar Vigyan/ Paak Kala: cooking process, science of ingredients, etc.
- Authentic recipes: Rare & Endangered Recipe ingredients, their adulteration in market Chyavanprash, other medicinal recipes.

The nutritional value of rich diversity in food

- Wild foods are important sources of micronutrients, their energy-density is generally low (with the exception of Honey & high-fat organs or in season fat deposits, Samson & Pretty 2006; McMichael *et al.* 2007).
- In the Sahel, several edible desert plants are sources of essential fatty acids, iron, zinc and calcium (Glew *et al.* 1997).
- In the arid Ferlo region of Senegal, some 50 % of all plants have edible parts, and commonly consumed are critical suppliers of vitamins A, B2 & C, especially during seasonal lean periods (Becker 1983).
- Lockett *et al.*(2000) found that among the plants used by the Fulani in Nigeria, available during the dry season (and important for ensuring year-round nutritional security in the face of possible food shortages) were superior in energy & micronutrient content compared with those from the wet season.

- ✓ Wild plants & animals form a significant proportion of global food basket
- ✓ Almost every ecosystem has been amended so that plants and animals can be used as food, fodder, medicines, etc.
- Some indigenous communities use over 200 (Kuhnlein et al. 2009); in India, 600 plant species are known to have food value (Rathore 2009); Some 1069 species of wild fungi consumed worldwide are important sources of protein and income (Boa 2004).
- Wild plants have diverse uses Kachchh, Jessore, Udaipur, Kalpavalli, etc. including food, Medicinal, beverage, oil yielding, dye yielding, craft making, hut construction, agriculture tool making & religious (food prog. 1998, 2000, 2002 2003, 2004, 2005, 2007, 2009, 2011, 2014, 2015, 2016,

- Wild foods provide a greater dietary diversity to those who rely on them.
 Ethnobotanical studies of wild plants indicate more than 7000 species have
 been used for human food in human history (Grivetti & Ogle 2000; MEA 2005).
- Despite their value (nutritional, medicinal, ecological), wild foods are excluded from official statistics on economic values of natural resources.
- There is substantial evidence that wild foods are an important part of the global food basket. At regional and national level, food balances guide policies on trade, aid and the declaration of food crises. The contribution made by wild edible species is notably absent.
- Local communities in their environments, use many wild plants and animals. Yet, provision of and access to these sources of food declining as natural habitats come under increasing pressure from development, conservationexclusions and agricultural expansion without ecological-holistic perspective.

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Major threats on Food supplying resources

- Maximum pressure of food production on agriculture lands
- Unplanned urbanization & increased demand of needs
- Development Juggernaut : Pressure of unplanned, unbalanced & unstoppable Industrialization.
- Market forced Mechanization -ecologically not sound
- Drastic landuse change/ resource over-use (over exploitation)
- Change in market interests, food habits, degrading traditional knowledge & deteriorating natural food supply

Problems of current food & nutrition status

- Agro fields become dump-yard of chemicals
- No living soil, No Soil Nutrients, No soil fertility, No productivity
- Indigenous seed diversity decreasing, maximum endangered...
- Foodwebs and foodchains in agro fields broken
- Ecoservices of agro fields collapsed (pollinators, Soil engineers, etc.)
- Local edible resources other than agriculture are diminishing from food system
- Current Agriculture practices need excessive water, ground water table decreased
- 'Developmental projects' degraded green covers, increased aridity, climatic changes affecting overall productivity & production
- Market oriented farming lead to grow cash crops with high inputs, leading crisis of food crop production, killing farmers
- Scientific relevance and values of our food system is gradually disappearing
- Fast foods, junk foods, processed foods, packaged foods are taking place in our festival celebration
- Adulteration in foods

Our friends in fields...decreasing diversity due to chemicals /pesticides

Gradually disappearing Indigenous Agro diversity including Millets ;

related traditional knowledge wisdom

and traditional healthy recipes

Gradually disappearing Diversity...(Few)

Сгор	Varieties	Colour	Remark	
Finger Millet	Laal Maal	Red	Less water crop	
0	Safed Maal	white	Less water crop	
Great Millet	Nali Jowar	Dark	Grain small	
	Safed Jowar	white	Grain Big	
Pumpkin	Bhurkola	yellow	Sacred	
-	Chaki	yellow	Small	
	Gol dangar	white	Round	
	Lamba dangar	yellow	Oval shape	
Rice	Basmati	white	More water needed	
	Dangar	white	Less water crop	
	Dhanadi	white	smallest grain, needs more water	
	Dudhmogar	white	Less water crop	
	Hegdo	cream	Less water crop	
	Hejni	white	Less water crop	
	Hutarhal/ Sustarsal	cream	Less water crop	
	Kajal	white	Less water crop	
	Kamod	cream	Less water crop	
	Maudiyu	yellow	Less water crop	
	Tana tondi	white	Less water crop	
	Vari	black coat	Less water crop	

Biodiversity to enrich fields

- Enhancing biodiversity allows natural agroecological processes and the ecosystem as a whole to build soil nutrients and natural resistance to pests and diseases; services typically performed by external inputs in monocrops where these natural processes are removed
- Mixing diversity:
 - Multi-purpose trees which give many benefits such as fodder, timber, firewood, medicine, bee forage, and fruit
 - Trees with small leaves that don't overshade the land.
 - Trees which drop their leaves in winter, such as mulberry, and melia.
 - Trees which don't compete with ground crops.
 - Trees which have deep roots that aren't damaged by ploughing, such as most legumes, and melia.
 - Nitrogen-fixing trees which increase nitrogen in the soil.
 - Trees which not require a lot of water, use amounts of water/rain available.

Traditional Mix cropping: Balancing Ecoservices •Laheriyu Khetar of Tribal region, Gujarat

In this mix cropping method, numbers of beds (*Paliya*) are more and parallel in the field. Each bed is for different crop and hence at the same time, grow more crops (legumes, millets, vegetables) of the season.

If Sesamum (Til) is grown in one bed, it can not grow properly so Sesamum crops are placed at distance.

Different kinds of indigenous trees/shrubs planted on the fence of field (Agro forestry).

In this method, in case of severe situation, one or two crop will be harvested and the farmer can earn and save his investment. Also such mix cropping helps to the soil matter balance and productivity.

Model Agro field of Jayesh Patel (Gujarat)

- Experienced badly with hybrids & chemicals so left
- Cultivating highly nutritious diverse local seeds, millets, vegetables
- Zero cost, Low carbon inputs
- Use of Indigenous floral species & Indian cow products (dung, urine) to make organic manure & biological pest controls in field at zero cost
- Organic manure helps soil health (Kankrej Gauvansh-4)
- Less water cropping
- Earning by mix cropping-vegetables, millets with good profits
- His father get cured from severe Asthma attacks due to chemicals
- Enjoying the healthy foods
- Completely left Chemical fertilizers & pesticides. Huge savings
- Strong species association of domestic & wild edible plants
- Agro forestry ecological fencing NTFP production increased
- Protected surrounding habitats of wild edible plant species

Conservation Issues...

- 1. Degradation of grasslands
- 2. Decreasing water regime
- 3. Forest degradation and Biotic loss
- 4. Extreme environment condition-low & erratic rainfall, high rate of evapotranspiration
- 5. Failure of natural regeneration
- 6. Increasing use of forest land in non-forestry works
- 7. Habitat alteration and loss
- 8. Heavy anthropogenic pressure
- 9. Human Wildlife conflicts
- 10. Indigenous cultures affected by rapid acculturation

Major problems...

- Networking problem among NGOs, Govt. bodies., Agri Uni.
- Govt. policy.. Expensive agriculture promotion in villages
- Faulty policies
- No benefits to the remote and poor farmers/communities
- No market linkage with interior/tribal farmers for direct benefits.

Heads I win, Tails you lose...

- Hybrid promotion... for more production?... For whose benefit?
- Hybrid and BT increase.....GDP of the country?.....OR.....
 Sick lands, Pollutions, Farmer suicides, Food scarcity, Nutrition crisis, Water scarcity (surface and ground both)!!!!
- Who helps them to destroy our own seeds, grains, millets, BD?

Consumers with access to global supplies of food are less vulnerable to local shortages caused by drought, disease or civil disorder.

-Alan Tennessen, Vice President, Cargill (the giant among grain merchants)