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Disparities of Agricultural Productivity in Balochistan
A GIS Perspective

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Abstract
A systems approach to agriculture has gained favour over recent years, partly because it highlights inter-relationships touching on some important agricultural issues. Nutrition may be denoted in terms of protein intake or calorific intake, but in view of the varied proportion of population in different age and sex groups, as well as groups based on occupational and biological needs, and the even varied nature of diet intake in various parts of the world, more so in Balochistan, a province of Pakistan, which is a part of the Third World countries, an estimation of the average calorific intake is a difficult task. A study of the Standard Nutrition Unit and Optimum Carrying Capacity is an indication of the availability of nutrition which may roughly correspond to the intake.

Introduction
The wellbeing of man in any society rests on food and shortage of food is one of the most alarming problems faced by the developing countries. Although food crises have occurred several times in the past, often showing their worst facets during famines, the question of food is assuming increasing importance because of the rapid rate of growth of population and the increasing awareness of inequality and disparity among the different strata of the populace (Carr, 1997). The question of food crops production and distribution is of great relevance and requires urgent attention.

Nutrition is an important factor which influences health of a person and all the nutrients needed by man to maintain good health come through food (Akhtar and Khan, 2004). Nutrition Status depends upon the food consumption patterns, economic level, socio-cultural background of the family, level of agricultural development and cropping pattern. Agricultural productivity gains are passed on to the consumer in the form of lower food prices which, in effect, raise the standard of living (Ahearn, et al, 1998).

The World Bank estimates that 75 per-cent of the very poor, or nearly 1 billion people, live and work in rural areas and depend on agriculture for their livelihoods, either directly or indirectly. Given that 90 percent of the food consumed in many developing countries is produced locally, production increases and product diversification could improve the health and well-being of the poor. Food security is the foundation for social security (USDA, 2003).

The per capita per year / per day consumption of food items is estimated on the basis of annual quantity of agricultural crops and rural population. Proper nutrition is the basic pre – requisite for a healthy body and mind. Malnutrition and under nutrition are the basic causes of the occurrence of diseases and poor socio-economic performance.

According to the WHO; nutrition is an input to and foundation for health and development. The Interrelationship between infection and malnutrition is well-

documented. Nutrition may be denoted in terms of protein intake or calorific intake, but in view of the varied proportion of population in different age and sex groups, as well as groups based on occupational and biological needs, and the even varied nature of diet intake in various parts of the world, an estimation of the average calorific intake is a difficult task (Burke, 2004). The significance of nutrition also lies in the fact that along with income it is one of the significant criterions of measuring poverty, which is one of the chief causes as well as manifestations of inequality.

Protein, energy and micro – nutrient malnutrition has a very severe impact on the potential development and productivity of people (Chakravarti, 1970). They contribute a great deal towards morbidity and ill health, growth, retardation and reduced level of physical, mental and developmental activities (Aykroyd, et al, 1996). The basic cause of these deficiencies is lack of adequate intake through diet. Poverty in many cases is the major basic cause of malnutrition. In Pakistan, per capita per day calories intake is estimated at 2306 for 2001-02 and protein intake per capita per day is 67.0 grams (Economic Survey 2003).

Study Area

Balochistan located in the south-western half of Pakistan, covers nearly 44 percent of its land mass. Balochistan lies between 24^o 53' and 32^o 05' north latitudes and 60^o 52' and 72^o 18' east longitudes. Physically, Balochistan is an extensive plateau of rough surface divided into basins by ranges of sufficient height to from obstacles to movement (Hughes, et al, 1977). It is sharply divided from the Indus plain by the Sulaiman, Kirthar and Pub ranges.

There are only three sizeable plain areas in Balochistan i-e- Kachhi, Lasbela and Dasht. The Kachhi plain being the most important. It consists of the areas of Bolan, Jhal Magsi, Nasirabad, Jaffarabad and parts of Dera Bugti districts formed by the Bolan and Nari rivers. The average height of the plain in the north is about 492 feet above sea level which decreases to about 164 feet in the south. It is the only plain area of the Balochistan province. Balochistan has inland drainage. No rivers carrying a large permanent flow of water are found in the province. For the greater part of the year the river beds contain merely a shallow stream which frequently disappears in the pebbly bottom. After heavy rains the rivers become raging torrents. The largest rivers in the province are Hingol and Bolan. The northern part of the province is drained by the Zhob River on the east and the Pashin Lara on the west. Further south Nari, Bolan and Kachhi receive the drainage of the Loralai and Sibi districts. The rivers draining the Jhalawan area are the Mula, the Hub, and the Porali. In Makran the Dasht River carries the drainage to the south, while the Rakhshan, confluence with the Mashkel River, towards the north.

The climate of Balochistan is generally arid and the province can be divided into four climatic zones:

Hyper-arid (0-100 mm/year)- Chagai, Makran coastal areas and south-east of Lasbela.

Arid (150 mm/year)- North east of Zhob, Loralai, Sibi, Kachhi, Lasbela plains, and Pab-Mor ranges

Semi-arid (200 – 250 mm/year)-Sulaiman Mountain range. Toba Kakari area, Marri Bugti areas and Pab Kirthar mountain ranges.

Dry (250 – 400 mm/year) – Northern Sulaiman and Brahui ranges.

The temperature regime in Balochistan is determined to a great extent by the altitude. The cool temperate climate occurs above 2.000 meters altitude. The areas between (1,300-2,000 m) have a temperate climate. The temperature region has one or more month per year with monthly mean temperature below 5^o C. Mean annual temperatures are from 10 – 18^o C. Frost and snow is common in winter. The continental low altitude belt

and lowlands have sub – tropical temperature. This temperature regime has one or more months per annum with monthly means below 19^{o} C, but all monthly means above 5^{o} C. Mean annual temperature are between 18^{o} C and 24^{o} C. Frost and snow are rare. Tropical temperature prevails in the low mountain belt and low land facing the Arabian Sea. Winters in this region are mild; the mean maximum temperature of the coldest month is about 13^{o} C. The mean annual temperature ranges between 29^{o} C and 37^{o} C.

In different ecological zones of Balochistan, crops of all the three major climatic regions (1) Tropical (2) Sub-Tropical and (3) Temperate are grown very successfully. The availability and source of irrigation water and the climate determine the cropping pattern, cropping intensity, and the choice of crops. Physical and chemical properties of soil also affect the production of crops. But the soil of Balochistan (with few exceptions) is suitable for growing crops. The following agricultural production systems are prevalent in the province. These systems however vary from area to area and in the same area different systems are simultaneously practiced depending upon the source of irrigation water.

1. Irrigated Agriculture

Main sources of irrigation are canals, tube wells, open surface wells, `karezes` and natural spring. Sub soil water is also widely used for agriculture. The sub soil water was traditionally tapped from natural springs or through `karezes`. However, these days tube wells have become more common. Tube wells are mostly used for raising fruits and vegetables and to supplement other sources of irrigation. Mostly deciduous fruits are grown in areas extending from Kalat to Quetta, Pishin, Killa Saifullah, Loralai. The orchards of deciduous fruits are inter-cropped during winter with wheat, barley and Lucerne. `Karezes` and natural springs are also used to grow fruits, vegetables, and fodder during kharif season. In recent years, a number of small dams have been constructed including Merani and Subokzai dams for irrigation to increase wide area for cultivation.

2. Dry land agriculture

Approximately 60 percent of total cultivated area is under dry land agriculture production system. The two prevailing systems in Balochistan are `Khushkaba` (rain fed) and `Sailaba` the flood irrigated. In `khushkaba` or rain fed system, agriculture depends on the precipitation or by harvesting surface runoff from uncultivated areas. The system is predominantly practiced in the northern part of the province especially in Tabina plateau of Chaman, Dasht in Mastung and in Zhob, at an altitude ranging from 4900 feet and 7800 feet and an annual rainfall from 250 millimeters to 350 millimeters mostly in winter. This area also receives snow in December-January and wheat is the major rabi crop. In sailaba or flood irrigated system, the flood water is diverted into big bunds about 0.5 to 3.0 meters high. This system is found all over the province where terrain permits, but main areas are Zhob, Sibi, Kalat and Nasirabad divisions. Wheat is the most important rabi crop in this system. Balochistan can be divided into four agro-ecological zones:

a. Uplands of Balochistan – Quetta division (excluding Chagai district),
b. Kalat division (excluding Lasbela and Kharan District),
c. Zhob division,
d. Sibi division (including Ziarat, Harnai and Kohlu (DCR, Balochistan, 1998).

$$Cc = \frac{Co}{Sn}$$

(i) C_c = Optimum Carrying Capacity

(ii) $C_o = \frac{\text{Total calories for ingestion}}{\text{Percentage of total harvested area}} \times 100$

(Where, 100 is used as hectares to convert the total caloric production to per square kilometer)

(iii) Sn = % of total rural population by category **X** Daily recommended caloric intake

Technique for Calculating the Optimum Carrying Capacity

Since the carbohydrate intake is so critical, this is generally the nutrition measure used to show differences in diet and food intake levels from one part of the world to another. It is measured in calories.

Singh, and Dhollon, (2004) has made an attempt, first, to determine caloric output (C_o) available for ingestion per unit area under food crops and oilseeds after making a careful total deduction for usages and wastages which add up to 16.80 per cent of the total production, and second, to compare the caloric output with the weighted average standard nutrition (S_n) for ingestion in calories/person/annum. Finally, the carrying capacity (C_c) can be expressed as,

Based on this corrected formula data for the ten food crops for the periods of 1998 and 1999 for the twenty-six districts of Balochistan have been taken and the relation between food crops production and population has been analyzed.

An intake of below 2000 calories per day for any population indicates malnutrition (Stamp, 1960). Shafi (1960), while working on the land-use of the villages in Eastern Uttar Pradesh, also concluded that where caloric intake drops below 2000 calories a day, both the standard of living and standard of health are noticeably poor.

Discussion

Nature, history, and economies have been generous to a portion of the world's population by providing food security and freeing societies from the burden of the constant search for food. A combination of productive land, favorable climate, natural resources, stable politics, and the application of science and technology under circumstances of advantageous marketing opportunity have produced a seemingly boundless and abundant food supply at a remarkably low cost (SOFI, 2002).

Food security is defined as access to sufficient food by all people at all times for active, healthy lives. As such, food security depends not only on how much food is available, but also on the access that people have to food–whether by purchasing it or by producing it themselves. Access depends in turn on economic variables such as food prices and household incomes, as well as on agricultural technology and the quantity and quality of natural resources (USDA, 2003).

The imbalance between the population growth and agricultural production is a serious challenge in most of the developing countries. The growing pressures of population and limited food supply have aroused global interest in research pertaining to environment, food and nutrition.

In recent years, concern for the environmental effects of agriculture has increased. The green revolution required considerable inputs of energy and chemicals. Some are

now questioning if these inputs can be continued indefinitely. The focus of some research is shifting to agricultural methods which do not appear to have limitations.

Table 1

(A) Calories per Kg. in food crops **(B)**Daily recommended caloric intake

S.No	Food crops	Calories /Kg
1	Rice	3450
2	Wheat	3490
3	Bajra	3610
4	Maize	3420
5	Sugar cane	3170
6	Wheat	3460
7	Barley	3360
8	Gram	3490
9	Pulses	3410
10	Potatoes	970

Age group	Children	Male	Female
under 1	700		
1--3	1200		
4--6	1500		
7--9	1800		
10--12	2100		
13-15		2500	2200
16-18		3000	2200
19 and over		2800	2200

Source: ICMR (Indian Council of Medical Research), Recommended Daily Allowances of Nutrients and Balanced Diet, Hyderabad**.**

Table 2 Rural Distribution of Population of Balochistan

No	Districts	under 1	1-----3	4-----6	7-----9	10--12	13 -- 5 M	13-- 15 F	16---18 M	16---18 F	19 & over M	19 & over F
1	Quetta	3913	21887	22196	18697	17038	6136	5283	7270	6247	46394	39743
2	Pishin	8299	42881	43738	36381	33629	13691	8898	11552	11536	66644	66979
3	Chagai	3069	18523	19506	17101	15252	5624	4448	6000	5093	39352	32700
4	Killa Abdullah	5351	37349	39001	32455	29825	12121	6883	10999	8845	66943	63705
5	Zhob	4957	27110	29942	26573	23678	10526	6059	8699	6053	45041	42661
6	Loralai	4075	25960	28253	25736	22931	9034	6084	9764	7947	62238	60549
7	Killa Saifullah	4088	19683	21175	17964	16346	6505	3903	5165	4957	34902	33566
8	Musakhail	1840	13070	15214	14268	12785	6329	2071	5109	2105	25670	24006
9	Barkhan	1860	9544	11070	9396	8199	2648	1693	3006	2458	23738	22263
10	Sibi	1505	11114	12746	11417	10619	3551	2756	4299	3597	33279	27689
11	Ziarat	815	3748	3668	3208	2903	1144	690	1099	1348	6659	7422
12	Kohlu	1501	8077	8976	9050	7095	3165	1430	2991	2374	24173	21349
13	Dera Bugti	4614	18795	20096	17261	13305	5017	2341	5451	4477	38951	35507
14	Jafarabad	7061	36736	41848	33373	27741	7874	5269	11538	11177	83562	81115
15	Nasirabad	3964	21471	24134	20620	16563	4654	3047	6270	5907	51369	49464
16	Jhal Magsi	1589	10284	12533	10359	9119	3228	1700	3634	2607	24009	22782
17	Bolan	4353	24102	28161	25392	22286	7412	5017	9147	6939	61643	54117
18	Kalat	4466	22607	24602	20790	18945	6420	4549	7023	6772	45090	42776
19	Mastung	2888	14728	15710	13508	11560	3857	3026	5049	4448	35502	30238
20	Khuzdar	6008	30421	35387	29819	27078	9354	6207	9575	8962	70749	65658
21	Kharan	4504	18278	20451	18556	16202	6375	4969	6269	6224	39283	37992
22	Lasbela	3983	18144	21451	17837	17738	6144	4661	6744	6064	49531	44974
23	Awaran	2692	12214	14165	11474	10588	3406	2504	3995	3674	27303	26158
24	Kech	9181	39331	41124	33479	28881	10255	7950	11488	13586	74862	74464
25	Gwadar	2222	9272	9871	8254	7851	2984	2353	3229	2782	19282	17246
26	Panjgur	6654	28670	28793	23709	20104	7893	5362	6452	6549	39991	38577

M. Male, F. Female (Table extracted from Districts Census Report, Balochistan, Government of Pakistan)

Such systems are being termed “sustainable agriculture,” which can be defined as an integrated system of plant and animal production practices that satisfy human needs.

Pakistan is an agro based country but is unable to fulfill its domestic need of food. Although it has a large area of acreage, shortage of water is the main natural agricultural problem. In Pakistan two provinces mostly produce food crops. Punjab has leading position while Sindh has sustainable condition. Balochistan and N.W.F.P. province not produced varieties of food crops for their population.

The present study is undertaken at micro level in order to analyze the agricultural production of food crops and rural population of the area of Balochistan by district level. Table – 1 shows calories pre kilogram for selected crops and requirement of per day energy for different age groups Table – 2 shows age structure of rural population by district of Balochistan and also denotes the need of food crops according to per day calorific need. Table-2 has been extracted from DCR, Balochistan 1998.

Available daily calorific intake in Balochistan - districts can be seen in Fig 1. Four districts of Ziarat, Lasbela, Sibi and Nasirabad, have highest amount of calories for ingestion, so we put these districts in group one. Seven districts, Jafarabad, Chagai, Kalat, Khuzdar, Jhalmagsi, Pishin and Quetta are in group two. Kharan and Bolan two districts in group three. Seven districts of Killasaifullah, Loralai, Kech (Turbat), Barkhan, Zhob, Musakhail and Mastung in group four. Dera Bugti, Kohlu, Panjgor, Gwadar, Killabadullah and Awaran six districts are in group five. District of Killa Abdulallh grows

only potatoes in low quantity which has low calorific value, therefore it is categorized in the lowest category, while Awaran is a desert area where no agricultural food crop cultivation is found, so it records no calories for ingestion.

Among the twenty six districts of Balochistan (1998) ten districts have optimum carrying capacity above province average (7.99 persons), while 16 records below state average. The districts of Ziarat, (16.905 person) Lasbela, (12.093 persons), Sibi (10.756 persons), have significant carrying capacity as can be seen from Fig.2. The districts of Nasirabad, (9.597 person) Jaffarabad, (9.552 person) Kalat, (9.430 person) Chagai, (9.350) Khuzdar, (8.958) Pishin (8.842 person) Jhal Magsi, (8.744 person) are much better because these districts have near province average of carrying capacity. Quetta, (7.723 persons), Kharan, (7.290 persons), Killa Saifullah (7.25 persons), have low value of carrying capacity. These are districts showing below province average carrying capacity Kech (7.095 persons), Bolan (7.081 person), Loralai (6.968 person), Barkhan (6.567 person) Zhob (6.484 person), Musakhail (6.204 person) Dera Bugti (5.722 person), Mastung (5.718 person). Panjgor (4.995 person), Kohlu (4.794 person), Gwadar (3.645 person), have low value of carrying capacity. Killa Abdullah and Awaran are very poor districts in terms of carrying capacity.

Conclusion

Mostly districts of Balochistan province have very low values of carrying capacity, which are the reasons of illness weak health, low quality of life and poverty. These areas are backward in all manners. This study has revealed a very interesting situation that most districts of Balochistan do not have a variety of food crops, except Nasirabad, Jaffarabd, Sibi and Lasbela. Ziarat leads in carrying capacity although it has only one crop i.e. potato which has low energy. This study has revealed that Balochistan's nutritional condition is not supportive or adequate for maintenance of good health. Balochistan depends on other provinces for it's requirements of wheat, rice and other food crops for subsistence .

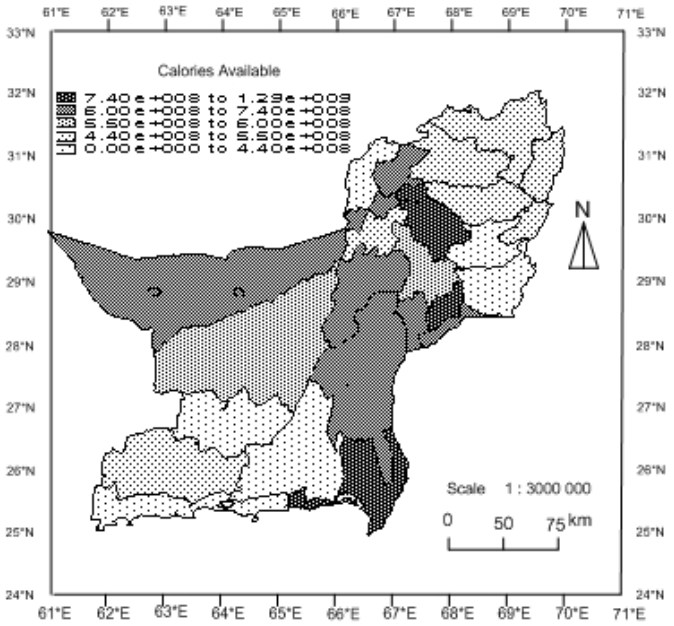

Figure. 1 Calories available for Ingestion - Districts of Balochistan

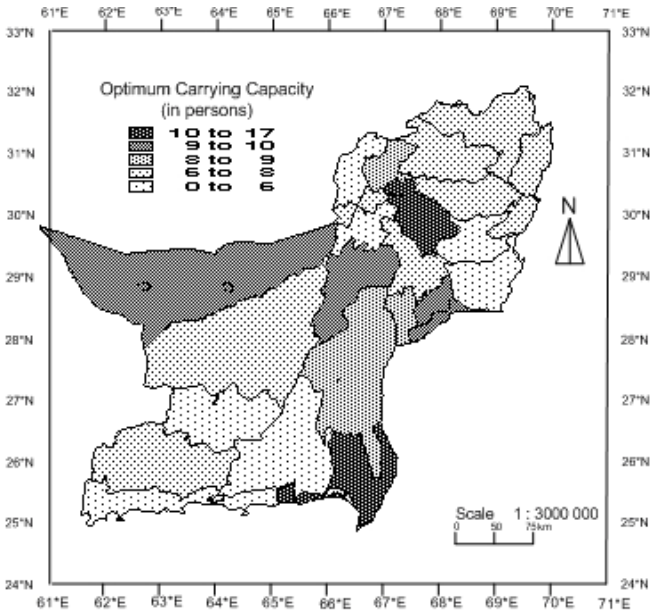

Figure 2 Optimum Carrying Capacity by Districts of Balochistan

One of the basic causes of low carrying capacity apart from natural infertility of the soil is the shortage of water, because the province depends on traditional canal systems i.e. 'karezes' and tube wells for irrigation to supplement its scarcity of water due to inadequate rainfall and inland drainage. No rivers carrying a large permanent flow of water are found in the province. However, the BCIAP (Balochistan Community Irrigation & Agriculture Project) (World Bank, 2002) which was initiated in 1995 and closed in 2002 has done a lot to handle the water problem for Balochistan's agricultural sector. The initiative of General Pervez Musharraf in Balochistan is highly commendable. The construction of the Kachchi Canal, the Mirani Dam etc. are among the most notable projects in Balochistan; not to forget the Community Management in ground water at Panjgur and Mastung. Since water is the limiting factor of agriculture in Balochistan, this problem must be given top priority in order to facilitate agricultural productivity.

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