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Environmental Targets and Measures in the Strategies and Programmes of Regional Development in the Czech Republic

By Alois Hynek & Jan Trávníček
Masaryk University Brno, Czech Republic

Abstract - The presented article examines the state of environmental politics in the Czech Republic, specifically the Moravia Region. This issue area is connected to more theoretical questions of how to understand the relationship between the environment and politics. Thus, after an analysis of the Czech environmental legislation, two related theoretical lenses are discussed: political ecology and environmental security. As will become clear from the discussion, the conceptual distinction which is relevant in this context is of the link between landscape and spatiality. What follows is an outline of an original synthesizing scheme with dimensions. The second part of the article uses the above insights to shed light on spatial landscape ecosystems in South Moravia region of the Czech Republic. In concrete terms, environmental targets and measures of regional environmental development are scrutinized. The article is summed up in the conclusion.

Keywords : *regional development, environment, cultural landscape, targets and measures.*

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Alois Hynek [α] & Jan Trávníček [σ]

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I. Introduction

With respect to the Czech government resolution # 235/98, dated on April 8th, 1998, including the Czech government´s regional policy principles´ new administrative division of the Czech Republic was approved by the Parliament as higher regional self-governing units (HRSGU, kraje in Czech, Act # 347/1997, Statute Book). Their main purpose has been proposed for balance regional development and gradual reduction of their economic and social disparities. In the years 1998-2002 strategies and programmes for regional development of HRSGU were elaborated proposals in further reference to National Strategy of the Czech regional development and sector operational programmes. The main parts of regional strategies were: economic development, social development, culture/education, infrastructure logistics, environment, tourism and external relations.

Teams of experts used methodology as standard practice in EU interpreted for the Czech Republic by DHV Czech Republic (A. Kutscherauer, M. Hučka, 1998) containing sources, organizations, institutions, tools, plans, sector and regional programmes running to implementation, recommend-ations in targets and measures. This paper recapitulates the experience in control boards, regional coordination group and expert groups based on negotiation and facilitation. The research question posed is the following: How to think about landscape ecosystems and what has been their presence in the South Moravia region?

Authors α σ : Masaryk University Brno, Czech Republic.
E-mails : hynek@sci.muni.cz, jan.travnicek@mail.muni.cz

II. Czech National Environmental Agenda

Shortly after 2002 the new aims and objectives for environmental policy were stated in The Czech National Environmental Policy in the years 2004-2015 and incorporated into regional development strategies and programmes of HRSGU:

- NATURA 2000 – areal regimes and management (including SEA technique)
- EIA/SEA respecting EU Directive 2001/42/ES and Aarhus Convention
- Action plan and monitoring nitrogen pollution of water caused especially by agrochemicals
- Waste recycling including not only collecting sites but also environmental education
- Reduction of toxic substances in surface and underground water
- Fluvial ecosystems management respecting EU frame directive 2000/60/ES and 2001/42/EC – monitoring and planning, measures, public hearing
- Sewage water treatment plants construction and reconstruction (nitrogen and phosphorus reduction)
- PCB/PCT inventory and inspection, decontamination and deactivation
- Biologically decomposable solid communal waste salvage, separation and composting
- Air pollution reduction in integrated programmes and local plans
- Achieving 8% share of renewable energy resources in electricity consumption

III. The Politics of Political Ecology or Environmental Security?

Recent scholarship on the link between the realm of politics and environment is fragmented. The two most recognizable strands are represented by the discourses on political ecology and environmental

security. After their definitional and conceptual analysis, one realizes that these two discourses significantly overlap. Why, then, not to have just one? The explanation becomes obvious when the disciplinary affinity of contributors to these discourses is examined. While political ecology has emerged as a subfield from the discipline of geography, environmental security can be seen as an issue area burgeoning within the confines of the disciplines of Political Science and International Relations, namely so-called Critical Security Studies. Disciplines thus play the role their name suggests: discursive policing, or disciplining. (Foucault 1981).

The term political ecology can be understood in many ways. From the "managerial perspective", it is deemed to concern the social and political conditions surrounding the causes, experiences, and management of environmental problems. (Blaikie and Brookfield 1987) Another account tends to conflate it with the term "politics of ecology" referring to political activism and social movements embracing Deep Green Environmentalism. (Atkinson 1991: 18) Finally, as Peter J. Taylor and Brian Wynne (1979: 20) propose, political ecology should be seen as the politics of the application of ecological science. However, none of the above perspectives study the relations between the field of political ecology and philosophy of science and sociology of knowledge. As a result, valuable insights of science studies or science-policy are avoided. A definition compatible with the aim of this article is provided by Tim Forsyth (2003: 4) who suggests that the term "critical" political ecology "may be seen to be the politics of ecology as a scientific legitimization of environmental policy." Such a definition is highly relevant inasmuch as it takes onboard the idea of socially-constructed science, be it constructivist empiricism, scientific realism or interpretivism. It imagines both nature and ecology as socially constructed objects – even though of different kind, thus leaving space for their deconstructions.

Reflecting on the term environmental security, an evolution of the term in the meaning we nowadays understand it can be explicated by focusing on the disciplines of Political Science and International Relations and their intellectual development after the Cold War. (for the overview of original scholarship on environmental security in the 1980s compare Dalby 2002: 16-19) The subfield of security studies has been largely transformed from the realm previously almost exclusively dealing with the notion of national security into the more diverse waters. The major transformation has consisted in so-called "deepening" and "broadening" of security. With regard to "deepening", the referent point is no longer the nation state, but also individuals, communities, or global ecosystem. What is more, the "broadening" of security studies leaves us with at least five different sectors – political, economic, societal, environmental and military- instead of an originally dominant military sector. (Buzan, Waever and Wilde 1998; Krause and Williams 1997) As a result, a distinct research agenda of environmental security emerges. It can be pointed out that environmental security directly challenges previously dominant ontology of the nation state and is largely based on an ongoing anthropological turn, which has opened up a larger canvass of questions appertaining to who is insecure and what their sources of insecurity are. (Dalby 2002: xxiiii) Not only ontology undergoes a significant shift – epistemology follows and reflects the fact that in order to understand a socially-constructed production of danger, interpretive epistemologies and methodologies need to be employed. (Duvall, Weldes and Laffey 1999).

Both portrayed discourses intersect in their attempt to investigate the connection and interplay between previously separated scientific and political agendas; as the point of departure, both of these agendas are treated as social constructs. What is challenged is the perception that tenets of environmental politics can be separated from assumptions and principles of environmental science. The strategy of examining both agendas as largely independent, stems from the conviction that politicians (or political scientists in their roles of political advisers) do not need to understand the issue in its biophysical substance. The fallacy of this point of view is to comprehend science detached and isolated from the realm of political practice, thereby avoiding the politics in the creation of the science itself. (Forsyth 2003: 9) One can invoke Foucault's notion of the power/knowledge nexus and the way, how one shapes another. These insights have been extended and served as the basis for the construction of the discipline of science studies and sociology of science. It is through the above disciplines that coproduction and hybridization come into being as primary objects of study. Sheila Jasanoff (1996: 393) defines coproduction as "the simultaneous production of knowledge and social order." Similarly, Bruno Latour (1993) analyzes the emergence of "quasi-objects" on the interface between nature and society. Ecological facts and discourses require for their existence political practices pertaining to environment and vice versa; put it simply, they are mutually embedded, or in the terms of reflexive sociology mutually constituted.

One of the ways through which scientific agendas and political agendas interact is the process of securitisation. Securitisation can be understood as "the move that takes politics beyond the established rules of the game and frames the issue either as a special kind of politics or as above politics." (Buzan, Waever and de Wilde 1998: 23). It is relevant to say that securitization does not work according to some real, out-there type of threat, but in fact, every issue can become an object of securitization by being lifted from the level of non-politicized to the level of securitized. As one can

imagine, the use of scientific knowledge plays very often a crucial role in reframing a given issue and presenting it in a different cognitive frame. The important fact is that the level of securitization of the issue does not equal to the level of politicization of the issue. While the latter would enable the issue to become an object of political debates and political negotiation and bargaining process, the former guarantees to securitizing agents (i.e. who securitizes the issue) a type of ´monopoly´ to present the issue as threat and priority and consequently as a taboo that cannot be an object of political debates. What one faces is therefore a socially constructed and intersubjectively imagined importance framed as a threat that consequently materializes, the threat becomes real.

IV. What is *Landscape* Spatiality, or Spatialities of Landscapes?

Landscape is a common word but also a geographical term. In the use of the latter it has been used very broadly in various contexts: to give but one example, landscape can be understood as an intersection of individual, formal or generic meanings, which are – in our point of view juxtaposed, not contradicted. Landscape is said to represent scenery, or sometimes is denoted to an observed or observable territory in a single view.

Cosgrove (1998) has maintained that landscape is more about the way one sees things, than as a ready image or object. Writings of both Barrows (1923) and Hagget (1983) lay emphasis on the process of forging a relationship between people and land, with human environment as a resulting object of study and human ecology as a discipline studying the former.

A different perspective is offered by C. Troll (1939, 1970) who investigated in his works the complex of causal and reciprocal connections between biological communities and their environment in a particular section of landscape. Troll's usual analytical level was the pattern of landscape ecosystems at choric/regional level. The paramount objective of such a point was to create a unifying approach which would eventually merge natural science with social geography. It is in this context that the notion of complex metabolism between nature and society underpinned by processes of reproduction and consumption is introduced.

Landscape spatiality can also be understood through an idea of territorial infrastructure. Such infrastructure is constructed as a vital organizational landscape to facilitate social production and reproduction. Relationship between economic production, social reproduction and political governance are constantly reconstructed, or in flux: Be it deindustrialization, urban sprawl, role of the cities – e.g. the shift from welfare to workforce. Cities are replacing states in the construction of social identities, they are landscapes of social production rather than reproduction (cf. Taylor 1996).

The perspective of landscapes as distinct associations of forms, specifically between a physical and cultural dimension, is taken by C. Sauer. The author uses structurationist theory of Giddens, introduced earlier on, to demonstrate that landscapes are products of cultures and also reproducing them through time. In other words, every cultural region includes its matching landscape. This perspective is further elaborated in the strand of human geography drawing on cultural studies with its use of iconography and text metaphors for perceiving and imagining landscapes (cf. Cosgrove and Daniels 1988, Duncan 1988). M. Crang (2001) explicitly talks about double encoding of landscapes: Landscapes are understood as wrapped in another representation, characterized by a simultaneous existence of multiply environments, as a bank of cultural memories. There is also a moral subtext to all the above since landscapes are seen as properties and an ethical argument that they should be owned by those beholding it is being articulated. The process of capturing and controlling the land thus occurs in a non-material way, through their representations in maps and in paintings as well as through fashioning landscapes on the ground using design and architecture. The landscape then, far from being neutral and inert, has social and cultural meanings, a symbolism, hence the word iconography.

In contrast to this approach of understanding landscape spatiality stands out the perspective of land management framed by state and shaped by economy (cf. Blaikie 1985). This perspective has been paying a lot of attention to the discourse on management; problems of landscape can be solved through problem-solving managerial practices of experts. An important question of how politics as policy of resource management and how control over the environment is discursively constructed immediately crops up (Moore 1995, Leach and Mearns 1996).

Moreover, there has been a motley bundle of geographers who have been paying attention to both economic/material processes and discursive constructions, with their interplay as the central issue. M. Crang (2001) evokes the notion of palimsest with the landscape as the record of change: Cultural values change so new forms are required. This process is said to include past practices and knowledges and features series of layers - abiotic, biotized, biotic, anthropized, anthropic, and noospheric. Cultural landscapes are concurrently conceptualized as other spaces/places: They are constructed both materially and discursively, with each construction affecting the other (Allen, Massey, Cochrane 1998).

Finally, we cannot omit Foucault's contention asserting that the operation of power or the constitution of subjectivity is always connected to an examination of how power, space and subjectivity entail production of

space. This idea has been consistently pursued by B. Latour (1993) who coined the term spatialization. According to this author, spatializations are not just physical arrangements of things, but spatial patterns of social action, kind of embodied routine, as well as historical conceptions of space and world. Landscapes are subsequently described as concrete instances of spatialization.

Landscape tradition in Czech geography is very short and as a subject of study belongs almost exceptionally to physical geography while regions are studied mainly by human (in Czech geographical terminology - by social geographers, but in the international sense – human geographers). After XI/89 more attention is paid to urban and rural studies.

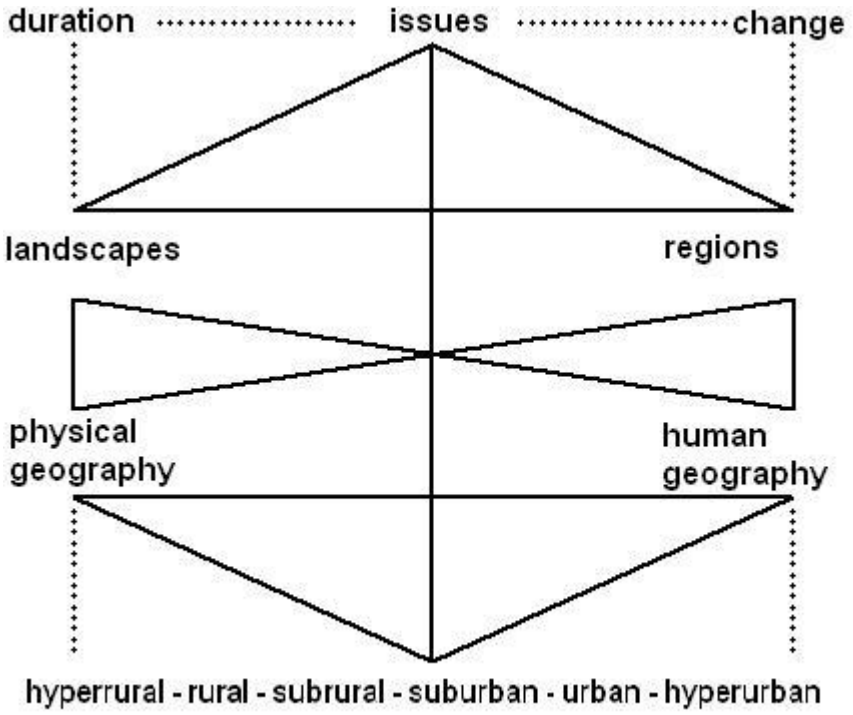


Figure 1 : Domains of Czech physical and human geography

V. How Many Pillars to have for Sustainability?

The current concept of sustainability is a favourite bone of contention between its defenders and opponents. In defiance of the latter, it is still a living theme. Our contribution appertains to the deepening of the conduct of sustainability by several ideas and practical illustrations.

Having been inspired by the above authors, we advance a model of sustainability in spatial sense – ESPECT/ TODS. The matrix of the model consists of six main poles through which ´reality´ is often depicted, though usually in isolation from one another: E(conomy)-S(ociety)-P(olitics)-E(cology)-C(ulture)-T(ec hnology). The strategy to arrange them in a hexagon represents an effort to overcome this usual isolation and lack of interconnectedness (i) as well as to emphasize the equality of each and every node (ii). In other words, these poles, or nodes, are artificial subsystems which try to paint ´reality´ through their own intellectual categories and tools. One needs to bear in mind, however, that while science is rough, life is delicate and it is the practice of writing that rectifies this distance (Barthes 1978).

This is what the outer circle signifies – the wholeness, unity, or synthesis through a two-way rotation which implies the need to overcome the dogma of six artificial points of view. The strength of this framework in regard to the outer circle and its underlying hexagon is grounded in the need to hybridize and thus synthesize findings of otherwise six isolated subsystems into a single account; we constantly need to be reminded and aware of the fact that phenomena out there are not created through isolated intellectual subsystems, but are, in fact, coproduced.

As far as the inner rhombus with nodes T(emporality)–O(ppression)–D(ominance)–S(patiality) is concerned, it is based on two sets of dyads (T x S; O x D) and its function is to explore simultaneously spatial and temporal effects of power/knowledge nexus. The oppression-dominance dichotomy can be spatially understood as the relationship between centre and periphery, and temporally as real and imagined lived

space in between them. It is also the case with respect to the rhombus that the unity and synthesis is being sought – this effort is again inscribed through a two-way rotary mechanism of the inner circle.

Finally, the inclusion of both the hexagon and rhombus into a single framework reflects the necessity for the researcher of investigating ESPECT and TODS as parallel, complementary and interconnected systems since it is not only through the synthesis of nodes, but also through an examination of processes which coproduce these geometric arrangements, that we can get a better grip on physical, social, and imagined ´reality´.

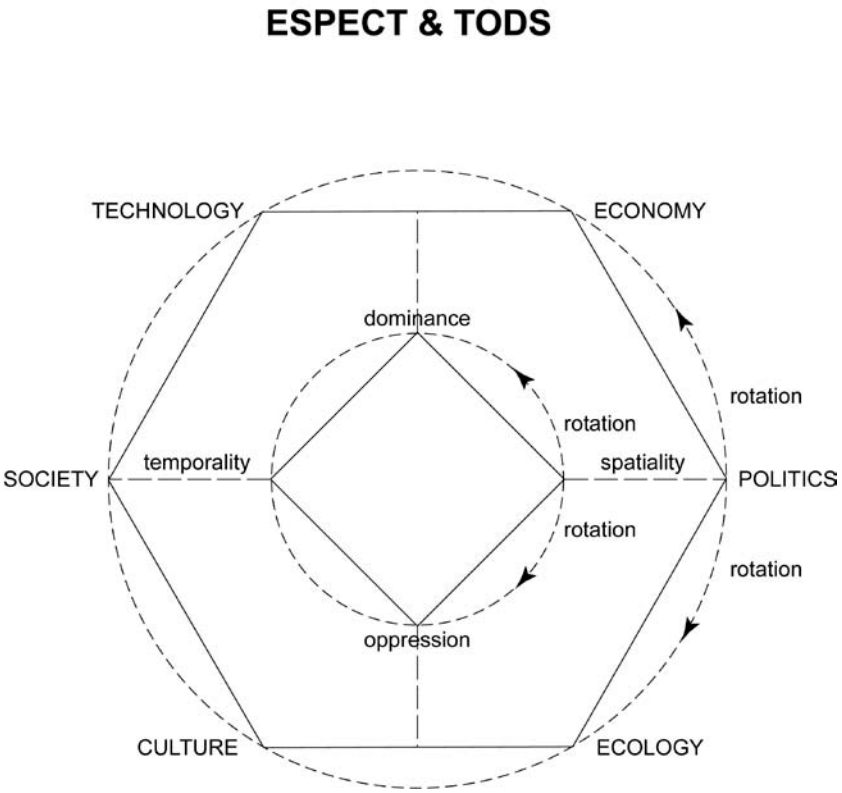
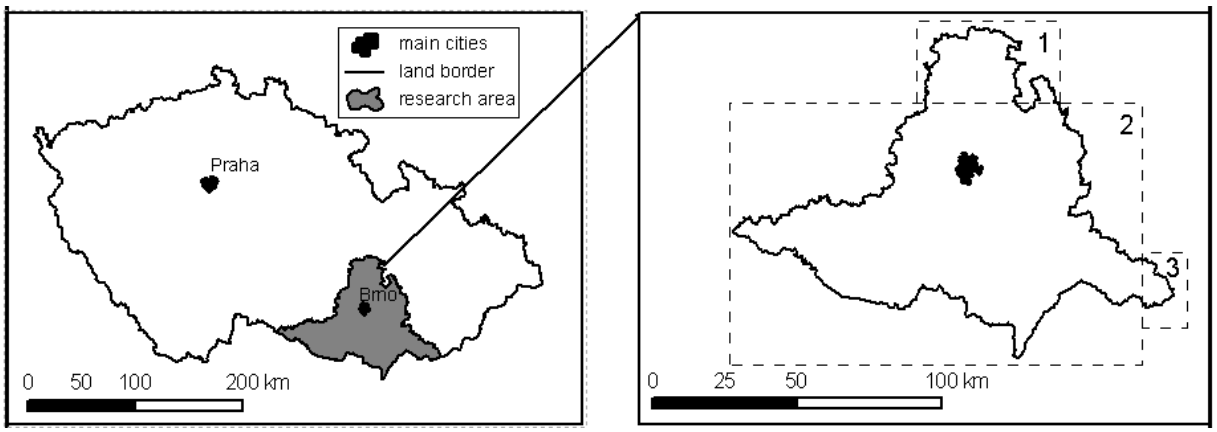
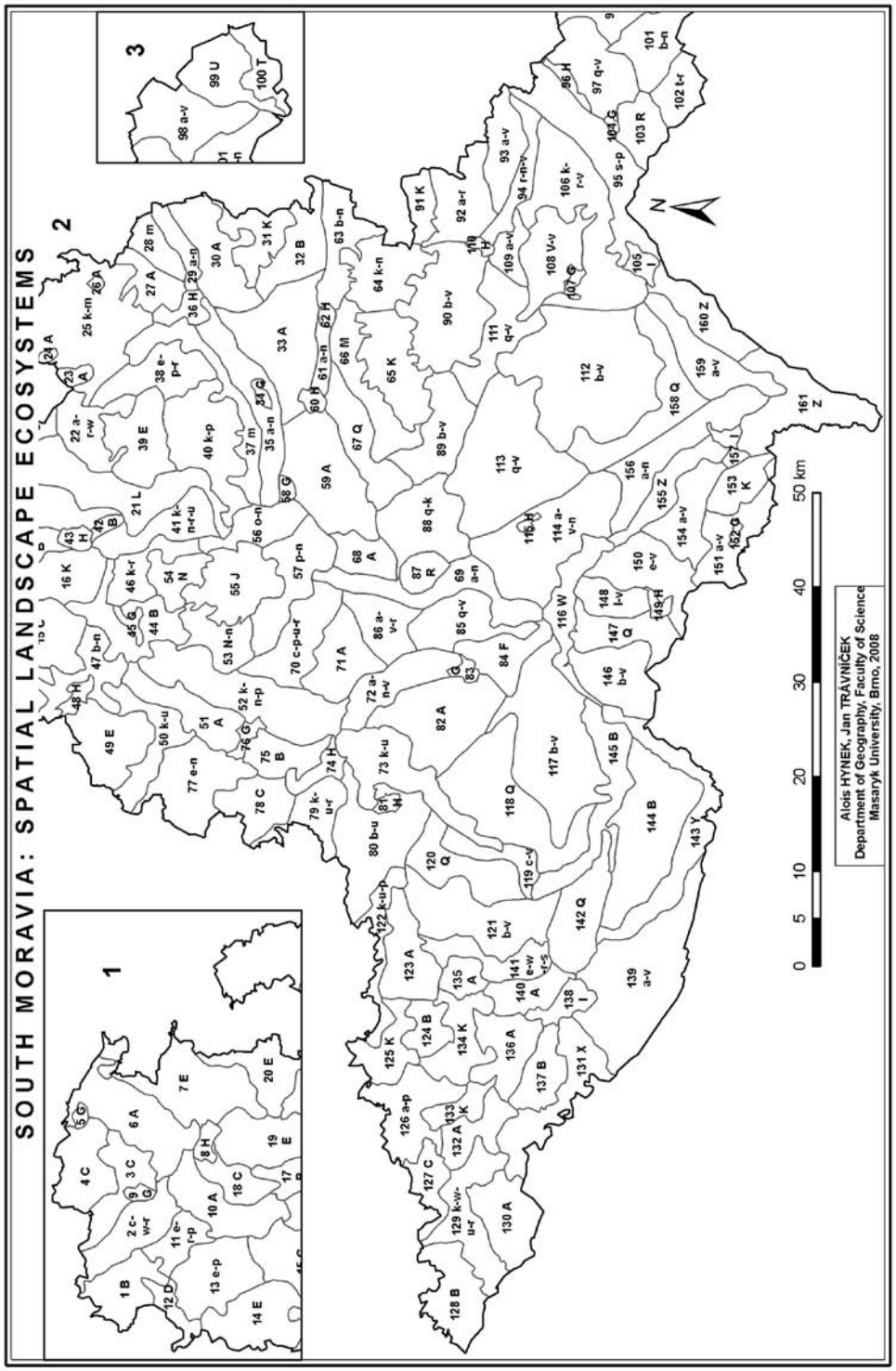


Figure 2 : ESPECT & TODS





SPATIAL ENVIRONMENTAL UNITS OF SOUTH MORAVIA

1	B	Olešnice rural	60	H	Slavkov urban/rural	119	C v Hostěradice rural
2	C w-r	Křetínka rural	61	A n	Middle Litava rural	120	Q Chlupice rural
3	C	Letovice rural	62	H	Bučovice urban/rural	121	B v Horní Dunajovice rural
4	C	Vlkov rural	63	B n	Upper Litava rural	122	K u-p Rokytná rural
5	G	Velké Opatovice urban/rural	64	K n	Eastern Ždánice-forest rural	123	A Běhařovice rural
6	A	Little Haná rural	65	K	Western Ždánice-forest rural	124	B Jevišovice rural
7	E	Kořenec rural	66	M	Kobeřice rural	125	K Kyničky rural
8	H	Boskovice urban/rural	67	Q	Šaratice rural	126	A p Modele Jevišovka rural
9	G	Letovice urban/rural	68	A	Otmarov rural	127	C Zálesí rural
10	A	Lysice rural	69	A n	Lower Svratka rural	128	B Uherčice rural
11	E r-p	Kunštát rural	70	C p-u-r	Lower Bobrava rural	129	K w-u-r Vranov/Dyje rural
12	D	Hodonín rural	71	A	Ořechov rural	130	A Šafov rural
13	E p	Bedřichov rural	72	A n-v	Dolní Kounice rural	131	X Podyjí National Park
14	E	Sýkoř rural	73	K u	Krumlov-forest rural	132	A Štítary rural
15	C	Lubě rural	74	H	Ivančice-Oslavany rural/urban	133	K Kraví rural
16	K	Hořice rural	75	B	Zbýšov rural	134	K Hluboký rural
17	B	Blansko rural	76	G	Rosice-Tetčice rural/urban	135	A Mikulovice rural
18	C	Obora rural	77	E n	Domašov rural	136	A Plenkovice rural
19	E	Holíkov rural	78	C	Chvojince rural	137	B Bezkov rural
20	E	Vysočany rural	79	K u-r	Oslava-Jihlava rural	138	I Znojmo urban/suburban
21	L	Moravský kras/karst	80	B u	Dobřín rural	139	A v Daniž rural
22	A r-w	Jedovnice rural	81	H	Moravský Krumlov urban/rural	140	A Únanov rural
23	A	Studnice rural	82	A	Loděnice rural	141	E w-r-s Deblínek rural
24	A	Nové Sady rural	83	G	Pohořelice urban/rural	142	Q Hodonice rural
25	K m	Dědice military training ground	84	F	Pohořelice rural	143	Y Jaroslavice/Dyje rural
26	A	Podivice rural	85	Q v	Písečná rural	144	B Karlov rural
27	A	Pustiměř rural	86	A v-r	Rajhrad rural	145	B Lower Jevišovka rural
28	M	Drysice rural	87	R	Výhon rural	146	B v Dunajovice hills rural
29	A n	Lower Haná rural	88	Q	Těšany rural	147	Q Dolní Dunajovice rural
30	A	Švábenice rural	89	B v	Borkovany rural	148	L v Pálava Biospheric Reserve
31	K	Hradisko rural	90	B v	Ždánice rural	149	H Mikulov urban/ rural
32	B	Hvězdice rural	91	K	Chřiby-western rural	150	E v Milovice rural
33	A	Letonice rural	92	A r	Moravany rural	151	A v Valtice rural
34	G	Rousínov urban/rural	93	A v	Domanín rural	152	G Valtice urban/ rural
35	A n	Rousínov rural	94	R n-v	Bzenec rural	153	K Boří-forest rural
36	H	Vyškov urban/rural	95	S p	Strážnice/Morava rural	154	A v Lednice rural
37	M	Olšany rural	96	H	Veselí urban/ rural	155	Z Lednice/Dyje rural
38	E p-r	Rakovec rural	97	Q v	Lower Velička rural	156	A n Podivín
39	E	Bukovina rural	98	A v	Velká/Blatnice rural	157	I Břeclav/Poštorná urban/rural
40	K p	Říčka rural	99	U	Suchov rural	158	Q Prechov rural
41	K n-r-u	Adamov urban/rural	100	T	Javořina rural	159	A v Tvrdonice rural
42	B	Olomoučany rural	101	B n	Čertoryje rural	160	Z Kyjovka/Morava rural
43	H	Blansko urban/rural	102	T r	Mandát rural	161	Z Morava/Dyje rural
44	B	Kuřim rural	103	R	Radějov rural		
45	G	Kuřim urban/rural	104	G	Strážnice urban/rural		
46	K r	Vranov rural	105	I	Hodonín urban/rural		
47	B n	Tišnov rural	106	K r-v	Doubrava-forest rural		
48	H	Tišnov urban/rural	107	G	Dubňany urban/ rural		
49	E	Deblín rural	108	V v	Dubňany rural		
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54	N	Brno northern suburban fringe	113	Q v	Boleradice rural		
55	J	Brno-city urban	114	A v-n	Hustopeče rural		
56	O n	Brno eastern suburban fringe	115	H	Hustopeče urban/rural		
57	P n	Brno southern suburban fronte	116	W	Nové Mlýny water works		
58	G	Šlapanice suburban/rural	117	B v	Litobratřice rural		
59	A	Lower Litava rural	118	Q	Miroslav rural		

THE SECOND LETTER AND NEXT LETTERS

- m military training grounds
- n settlement-transport-stream corridors
- p natural parks
- r recreation
- s orchards
- u incised valleys
- v vineyards
- w reservoirs, ponds

Table 1 : List of South Moravian environmental spatial units (see the map)

Primary domain A: Environment
Complete target of priority domain: Protection and improvement of environmental quality in South Moravia as a basic principle of sustainability, reduction of pollution especially in watercourses and reservoirs
Specific targets (ST)
ST 17. Restoration of small and medium watercourses, taking precautionary measures against floods Activities A1. Revitalization of water ecosystems and multiple use of watercourses To support processing projects which concern revitalization of water ecosystems – riverbeds, riversides, floodplains with wetlands, in conformity with money funds of State Environmental Fund, Ministry of Agriculture and water catchment managements in subsidy titles for the years 2007-11. To comprehend issues of watercourses and reservoirs as part of wider topic – wetlands in the sense of internationally accepted Ramsar Agreement. To emphasize the use of recreational potentials of watercourses in the towns/cities. To come up to expectations of South Moravian programme of Advancement in ducts and sewerage by supporting long-distance ducts as The Vir Reservoir Regional Duct and local prime quality water resources. A2 Restriction of activities in flooded areas and sensitive measures taken against floods To respect principles of a newly commissioned Plan of anti-flood measures, searching for new ways of launching into practice, which is based on the restriction of constructing new buildings in flooded areas and increased protection of settlements against floods. Deliberated introduction and testing crisis management in the case of exposure to floods linked with other natural hazards and risks caused by the land use systems. To accept water reservoir systems limits to reduce the risks of their flood conditions and the impact on residents.
ST 18. Enlargement of ecological stability area systems Activities: A1 Institutional promotion of area protection of constituent elements in European ecological network (EECONET) Trustworthy support of introducing protection/conservation referring to all constituent elements in physical ecosystems biodiversity and landscape values, especially area systems of ecological stability, large-area and even small-area nature protection, Natura 2000 system tracts, natural parks and outstanding landscape constituents in cooperation with the Czech Agency for Nature and Landscape Protection and administrations of landscape protected areas and national parks. To participate in the efforts to extend the forested_areas in South Moravia through implementing the South Moravian Forest Management Plan for reducing wind soil erosion. The cornerstone of measures on declared purpose of nature protection, by law, consists in maintenance and renovation of natural balance in landscape, protection of life forms diversity, natural values and beauties, well considered steps in natural resources management, with respect to economic, social, and cultural needs of residents on regional and local levels. A2. Strengthening the development of settlement sustainability South Moravian settlement sustainability should be reinforced by the endavour to eliminate hazardous concentration of air pollution, among others PM (particulate matter) 10 emissions and increasing noise level. It is necessary to prevent devastation of urban environment by harmful building intervention. Urban sprawl should be under public administration control for preventing destruction of (semi)natural landscape ecosystems. To subsidy public transport and upgrade communication maintenance. A3 Sustainability projects processing and assistance in their multi-sources implementation using EU, national, regional and local ones Sustainability is a long-term effort issue approached essentially as conceptual mode in all the sectors. Environment/landscape ecosystems and socioeconomic sphere are in close interlocking and it is impossible to achieve sustainability in one sector without achieving it in others. There is upcoming practicable management plan for protection and further development of all values of the Lednice/Valtice area in the Czechia/Austria transborder.
ST 19. Implementation of comprehensive programme in the Svratka-river basin above the Brno reservoir and in the Dyje-river basin above the Vranov reservoir including renovation of their recreational purpose Activities A1 Water quality restoration in the Svratka-river To develop project ´The Clear Svratka-river´ based on keeping contemporary directives concerning the water quality in water bodies and completed proposed measures in the Svratka-river basin. Submit a proposal on sewage water treatment plants in municipalities having 1,000 ´population equivalent´. To utilize the quality drinking water from the Vír Regional Duct (The upper Svratka-river basin) in the frame of well stocked inhabitants. In aid of water quality supplies local water sources are being accepted. In view of the planned survey covering the Svratka-river basin an analysis of sources, nutrient flows, anti-erodible measures reducing floating debris into the Brno reservoir is intended for construction of small retaining reservoir above it. More effective cooperation is supposed with the neighbour administrative region – The Highland – where the upper Svratka-river source is located. A2 Preliminary programme for restoration of water quality in the Dyje-river To appraise initial experience with the programme for restoration of water quality in the Dyje-river concurrent also for the Dyje-river

basin above the Vranov reservoir supposing the cooperation among the regions of South Moravia , The Highland and South Bohemia.

A3 Environmental purification of water catchments in South Moravia

To assist in preventive decrease of loading from the sources of pollution in agriculture (agrochemicals, animal waste) and pollution from settlement, industries, services, traffic and housing. To carry out in stages construction of sewage water treatment plants (SWTP) in municipalities with more than 1,000 ´population equivalent´, renovate outdated SWTP. To precede accelerated anthropogenous soil erosion causing, among others, silting up water bodies with sediments, including reservoirs and ponds. To evaluate data on water quality in reservoirs and gradually implement measures of incoming Plan for main basins (2009) referring to irrigation, sewerage, SWTP, floods protection in compliance with Water Act.

ST 20. Solution of human activities impacts upon the environment

Activities

A1. Management of old ecological burdens

To monitore the state of remedy concerning old ecological burdens and prevent the emergence of new ones utilizing GIS technologies in registration of waste dumps in South Moravia. To take part in converting closed old ecological burdens into close nature landscape ecosystems. To avoid neglecting alternative methods for identification of ecological burdens and carry proposals to convert them to environmentally sound state.

A2. Decreasing noise level

New ecological burden also consists of increasing noise level around frequented traffic lines (railways, roads) linked with growing number of vehicles and growing speed. It is especially important to search ways reducing noisiness in settlement. That is the reason for introducing noise protection as noise barriers and bypasses plus inspecting the speed limits on the roads.

A3 Industrial pollution reduction

In the case of industry it is necessary to ensure the agreed/approved norms of environmental pollution respecting environmental pollution limits and encourage the companies which introduce International Standards of Quality ISO, and also user-specific operating regulations EMAS (The Eco-Management and Audit Scheme (EMAS) is the EU voluntary instrument which acknowledges organisations that improve their environmental performance on a continuous basis). To support projects and measures ensuring reduction of industrial pollution and reduction of industrial impacts upon the environment in compliance with legislation in force.

A4. Waste management programmes implementation

To respect the principles of environmental policy of South Moravia in waste management declared in Waste Management Plan for the years 2004-2013. To support waste minimization and recycling. To insist on prevention of waste generation, or. its conversion into material resource. To train population to separate waste and especially to cointinuing process of separated waste. Scrapyards should be successively found in municipalities above 2,000 inhabitants and regional integrated sorting lines.

ST 21 Saving energy projects implementation

Actities:

A1 Subsidies for renewable energy sources use, initiation and implementation of energy saving projects

To subsidy energy saving projects, raise energy from renewable and alternative sources to complete their 8% share in energy consumption respecting national environmental policy targets.

A2. To strive to achieve regional energy independence

To take advantage of European and national funds for reducing energy consumption with a target of reaching gradual regional energetic independence on external sources by supporting public transport, savings in building heating, preferences to goods and services production minimizing waste of energy and support of agriculture and forestry production providing renewable sources of energy, especially biomass.

ST 22 Improving quality of environmental education,training and enlightenment

Activities:

A1 Implementation of environmental education, training and enlightenment concept

To strengthen and coordinate activities in environmental education, training and enlightenment. To endorse inception of centres for practising sustainability education according to European strategy (Vilnius, 2005) in the administrative districts of municipalities with extended powers. To interconnect these centres with NGOs (non-governmental organisations) and the network of primary and secondary schools. To encourage them to carry out common strategy, programmes and projects to boost introduction of Aarhus Convention, European Convention on Landscape, European Charter of Sustainable Tourism in Protected Areas, Charter of Sustainable Cities and next important international and national documents. To develop environmental education, nurture and enlightenment as a debate of various actors, communities, institutions and experts, including universities and research institutes, following active improvement of the environment by tangible results, projects, plans, programmes with active public participation.

A2. Promoting birth of Local Agenda 21 system (LA 21)

To spread LA 21 to seats with reasonable terms of effective implementation in public hearing of master plans, strategies, programmes and projects of regional/local development. To ensure effective dialogue of public administration, non-governmental organizations, experts, firms engaged in environmental management in accordance with Lisboa and Göteborg strategies and with respect to sound evaluation of the state of the environment after environmental indicators published by the Czech governmental Ministry of the Environment. To reinforce public participation in public hearing, decision-making and implementation of projects improving the quality of the environment and landscape ecosystems.

VI. Conclusion

Blazing a trail in coordinated landscape management and regional development as a principal tool of spatial environmental sustainability is not an easy task. The necessity of new politics of landscape, more attention to environmental security and opening the issues of *governmentality-environmentality-spatiality* is placed on the agenda. It is first of all the question of new environmental *discourse* starting with the rules of it, the roles of *actants* in the sense of B. Latour (1993). And there are more actors - *decision-makers, shareholders, stakeholders, experts* causing conflicts of interests for being included not only in one group.

The top-level problem is duality of negotiating process, accepting the otherness of participants, the art of hearing, tolerance and making a clean break with opponents changing it into common effort in following the targets and measures. Could the clean lobbing exit? Instead of disguising coercive forces advancing only their own interests and obsolete approaches absolutely going by European Union and other advanced societies.

The new public administrative division of the Czech Republic (2002) into 14 regions has been followed by intensive effort regarding new concepts and constructs of regional policy with respect to European Union practice and national tradition. The most important of them were analysed in the presented article. One of the important parts in this strategy of the regional development of South Moravia has been environmental quality and sustainability. The European Convention on Landscape, Millennium Ecosystems Assessment, e.g. have been applied in the process of negotiation including politicians/representatives, public servants, local authorities, experts, civil groups and individuals. The issues of cultural landscape improvement, environmental awareness and security, waste management, hydro-cycle renaturalization as well as renewable and alternative sources of energy have been included into everyday environmental agenda and examined accordingly. The paper reflected on rather different status of experts in the social fields of science on one hand and that of political agenda-setting and policy-making on other. It utilized on the interconnection between the authors´ hands-on experience and theoretical concepts dealing with the creation of scientific frameworks and political frames. The last part of the paper contained an environmental map of South Moravia which was intended to serve as an attempt to reconcile an ongoing debate regarding soft or hard sustainability.

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Growth and Yield Response of Irish Potato *(Solanum Tuberosum)* to Climate in Jos-South, Plateau State, Nigeria

By Ambrose A. Zemba, Solomon Z. Wuyep, Abel A. Adebayo & Clement J. Jahknwa
Federal University of Technology, Nigeria

Abstract - The study investigates the response of Irish potato to some climate variables in Jos-South Local Government Area of Plateau State, Nigeria. The data collected include yield of Irish potato, in tons per hectare, and climatic data for twenty years (1989-2009). These data were analyzed using descriptive statistics in Statistical Package for Social Sciences (SPSS) and later on subjected to correlation and regression statistical techniques so as to determine the relationship between yield of Irish Potato and climatic elements for different phenological stages of crop growth. The results show that there is no significant variation in most of the agro-climatic data between the different years. High variations in the values of agro-climatic are only found within total rainfall, rainfall in July, May, and to some extent, rainfall in April and June. Findings on the correlation analysis show that, at sprouting to emergence/vegetative stage, maximum and minimum temperatures significantly correlate with Irish potato at 1% significance level respectively. Also, total rainfall correlates significantly with yield at tuber set/initiation stage at 5% significance level. In the same vein, minimum temperature significantly correlates with yield at tuber bulking/ripenin stage at 1% significant level. Step-wise regression analysis selected two critical elements negatively influencing the yield of Irish Potato in Jos-South. These are minimum temperature at tuber bulking/ripening stage and rainfall in July.

Keywords : *climate, irish potato, sprouting, tuber bulking.*

GJHSS-B Classification : *FOR Code: 960399*

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Keywords : climate, irish potato, sprouting, tuber bulking.

I. Introduction

Irish potato (*Solanum tuberosum)* is said to have originated from the highland of Boloivia in South America (Martin and Leonard, 1949; Ifenkwe and Nwokocha, 1987). The spread of the crop outside its centre of origin was mainly by deliberate introduction. The crop moved out of South America to Spain in 1570; to England in 1585; then to Ireland by Spanish explorers from 1963. The crop was grown on a large scale in Ireland and became so popular such that it is not surprising that it acquired the misnomer of "Irish Potato".

In development countries, Irish potato is ranked first in energy production per hectare per day, significantly above cassava and cereals. It is a lover of cool climate and therefore requires a cool growing season with a moderate and well distributed rainfall of about 800mm during growing seasons with no prolonged dry weather. It could be grown under rain-fed condition or irrigated, but waterlogged areas are unsuitable. Temperatures higher than 27^0 C are unfavourable for the production of economic size tubers. Observations have shown that temperature ranges of 21^0C – 26^0C is required for sprouting of the tubers (Ahmed 1980).

Irish potato was introduced into Nigeria early in the 20th Century by European miners in Jos Plateau. Jos Plateau has high altitude and thus, cool climate, which is favourable for the development of the crop. Jos South Local Government Area (LGA) accounts for 25% of the total Irish potato produced in Nigeria (Okonkwo et al 1986; Wuyep 2012). The crop is efficient in converting land, labour, water and capital into a highly nutritious food. This is not surprising if for no other reason than it has a shorter growing cycle of about 95 days than most other tuber crops in the tropics.

Irish potato is an important staple food as well as raw materials for industries. In order to meet the demand for industrial and human consumption, the yield per hectare needs to be improved. Such imminent improvement could be achieved through efficient management and monitoring of agro-climatic parameters, among others. Several studies have been conducted towards improving the yield of Irish potato. For instance, Damkor (1983) based his studies on effect of stem thinning on yield and other vegetative characteristics; Ajala (1981) studied growth development and yield in four varieties of Irish potato; Szlachetha (1982) studied flowering behaviour of some varieties of Irish potato; Sale (1973), Susnochi and Shimshi (1985), Zaag and Burton (1973), and Wolfe et al (1983) carried out a study on water stress and related analysis on different varieties of Irish potato.

In Nigeria, Ifenkwe and Okonkwo (1983) conducted a study on determination of the most suitable

Authors α, ρ : Department of Geography, Federal University of Technology, Yola, Nigeria. E-mail : aazemba@gmail.com
Author σ : Department of Geography, Plateau State University, Jos.
Author ω : Department of Geography, Adamawa State Polytechnics, Yola, Nigeria.

time to plant Irish potato, while Ifenkwe (1989) did a comparison of flat lands and ridges for dry season planting on potato. Such studies have however, not been usually geared towards determining the relationship between climate and agricultural production, particularly considering Irish potato. There is no doubt that analyzing the effect of climatic elements from the point of view on how they influence our agricultural activities is important in any meaningful plan for increase crop yield. Thus, microclimate studies have become imperative in our studies of the crop-weather relationship in the study area.

Interestingly, the National Root Crop Research Institute (NRCRI), Vom and other agricultural research institutions in Nigeria and abroad have made notable achievements in increasing the yield of Irish potato. The crop breeders have developed varieties of Irish potato, which are capable of responding to improved cultural practices. They have gone a long way towards solving the pests and diseases problems both in the field and storage (Okonkwo 1992). In other to sustain these improvements, an appraisal of climatic parameters affecting Irish potato has become necessary.

In addition, there has been appreciable increase in the land area and output of Irish Potato in the area. This increase could be attributed to advances in agricultural technology such as the introduction and provision of extension services as well as way of diversifying sources of livelihood (Wuyep, 2012). However, despite the advanced techniques used in crop husbandry, the yield of Irish Potato is still variable over time and space in the area. Climate appears to be the major factor influencing the spatio-temporal variations in the yield of Irish potato in this area hence, the need for a research like this so as to unveil the prevailing situation.

II. Study Area and Methods

This study investigates a crop-climate relationship using experimental approach. An experimental farm located at the Headquarters of the National Root Crop Research Institute (NRCRI) Vom, in Jos-South Local Government Area of Plateau state served as source of data for the study. The site lies on latitude of 8^0 43'N and Longitude 8^0 46'E with an altitude of 1293.2m above sea level. Jos-South Local government area is one of the seventeen Local government areas in Plateau state of Nigeria. It is made of four districts; these include Vwang, Du, Gyel and Kuru.

The Local government area has its Headquarters in Bukuru which is located south of Jos-North Local government. It is bounded by Barkin –Ladi Local government to the South, Riyom Local government to the South West, Jos-East Local government to the East and Bassa Local government to the West. The Local government has a population of 650,835 (National Population Commission, NPC 2006) with an average land area of 1, 037km^2.

Two sets of secondary data were collected from the National Root Crop Research Institute (NRCRI) Vom. The first set is agricultural data for Irish Potato yield in tonnes per hectare of the Nicola specie over a period of 20 years (1989 to 2009). The second set of data is the basic agro-climatic variables influencing Irish Potato yield over the same period for the months of April, May, June, July and August. These months constitute the growing season on the Plateau. The final yields of crop are in many cases dependent on satisfactory growth during earlier stages of crop development. In all nine climatic parameters collected during the growing season were analyzed with a view to estimating their contribution to yield of Irish potato. These comprise three critical climatic data including rainfall; air temperature and soil temperature. Rainfall data were classified into total rainfall and rainfall amounts in April, May, June, July and August. Rainfall from April to August constitutes the rainy season in the study area. Temperature data were categorized into minimum and maximum temperatures. These data were analyzed and subjected to different statistical techniques, including correlation coefficient and multiple regressions.

In order to select the agro-climatic indices that are critical to the yield of Irish Potato, a step- wise multiple regression analysis was adopted. The yields were expressed as dependent variables (Y) and climatic indices as independent variables (X). The general form of the multiple regression equation is presented as follow:

$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + \ldots + b_nx_n$, where,

Y = Irish potato yield in ton/ha

a = constants

b = is the rise or falls as X increases

X_1 = total rainfall (mm)

X_2 = maximum temperature ^OC

X_3 = minimum temperature ^OC

X_4 = soil temperature ^oC

X_5 = Rainfall in April

X_6 = Rainfall in May

X_7 = Rainfall in June

X_8 = Rainfall in July

X_9 = Rainfall in August

III. Results and Discussions

Results and discussions in this study are considered under three sections. The first section treats the characteristics of the agro-climatic variables. This section was analyzed using descriptive statistics. The second section presents the relationship between agro-climatic variables and yield of Irish potato while the third section discusses the critical agro-climatic factors influencing the yield of Irish potato on the Plateau.

a) Characteristics of Agro-Climatic Parameters

The descriptive statistics of the agro-climatic variables (Table 1) were derived using SPSS statistical package. The mean total rainfall (692.62mm) meets up with the requirement for Irish potato production. However, there is high variation between the annual data as seen in the results for range (196.80) and variance (3182.42). The average minimum and maximum temperatures of 24.82 ^{0}C and 18.85 ^{0}C respectively are within the range required by Irish potato crop. The standard deviation of 0.6 and variance of 0.4 in both cases means that there is less dispersion within the values. Soil temperature has similar pattern of variation like air temperature. With a standard deviation and variance of 0.6 and 0.4 respectively, it means that the element portrays a near uniform characteristics throughout the growing season on the Plateau.

Table 1 : Descriptive Statistics of Climatic Variables and Yield of Irish Potato (1989 – 2008)

Variables	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Total Rainfall (mm)	20	196.80	575.30	772.10	13852.30	692.62	56.41	3182.42
Mean Max. Temperature (^{0}C)	20	2.60	23.30	25.90	496.40	24.82	0.601	0.36
Mean Min. Temperature (^{0}C)	20	2.00	17.80	19.80	376.90	18.85	0.59	0.35
Mean Soil Temperature (^{0}C)	20	2.40	23.40	25.80	491.70	24.59	0.63	0.40
Mean Rainfall in April	20	55.60	40.30	95.90	1383.40	69.17	18.23	332.40
Mean Rainfall in May	20	70.30	126.10	196.40	3155.90	157.80	22.89	524.14
Mean Rainfall in June	20	50.80	129.30	180.10	3129.20	156.46	12.48	155.83
Mean Rainfall in July	20	99.20	213.10	312.30	5279.40	263.97	25.97	674.46
Mean Rainfall in Aug.	20	21.40	30.00	51.40	821.60	41.08	6.58	43.23
Yield (tonnes/hectare)	20	8.70	11.10	19.80	286.50	14.33	1.99	3.94
Valid N (listwise)	20							

Source: Calculated from the agro-climatic data used for the study

There seems to be high variability only in April to August rainfall amounts between the years. This variation tends to be more in the months of July and May, while the month of August exhibits a lower variation (3.94) in rainfall amounts within the 20 years considered. It can therefore be concluded that the variations in the agro-climatic data presented above is partly responsible for the nature of variations in the yield of Irish potato in the area. The standard deviation and variance of 1.99 and 3.94 respectively, for the yield of Irish potato is relatively high. This calls for further probe into these factors so as to determine the degree of contributions of each of these factors. It is on the basis of this that the use of correlation and regression analysis was employed to determine the contribution of these factors to growth and yield of Irish potato.

b) Agro-Climatological Factors and Irish Potato

At the various stages of Irish potato development, striking findings were observed (Table 1). For examples, the result of the correlation analysis between yield and the climatic parameters at sprouting to emergence stage revealed that maximum temperature and minimum temperature have significant correlations ($r = 0.594$ and $r = 0.548$ respectively) with Irish potato yield, at 1% probability level. This indicates that, temperature range of 21-26^{0}C is good for sprouting of Irish potato. This consequently, plays a vital role in determining higher yield obtained on the plateau. The high correlation obtained in this study confirms the assertion made by Ahmed (1980) that temperature ranges of 21-26^{0}C is required for sprouting of tubers. He reported that a shift in temperature range of 21^{0}C - 26^{0}C at sprouting to emergence/vegetative stage may often induce knobbiness and secondary growth in tubers and consequently affects the yield negatively.

At the tuber set initiation, total rainfall was found to correlate significantly ($r = 0.470$) with Irish potato at 5% probability level .This signifies the importance of moisture during the tuber set/initiation stage. It confirms the findings of Levi (1999) and Eliot (2007) that precipitation is significant and positively correlated at tuber set/initiation stage with Irish potato in Ireland. The plants require more frequent supply of rainfall than many other tuber crops. It is the moisture and nutrient within this stage that is useful to the plant. Water is required for transpiration and regulation of leaves temperature (Burton 1989).

However, at the tuber bulking or ripening stage, minimum temperature was discovered to correlate negatively ($r = -0.616$) at 1% probability with Irish potato. This shows that the lower the temperature during this stage, the higher the yield will be. This result confirms the assertions made by Levi (1999) and Eliot (2007) that minimum temperature of 15^{0}C at tuber bulking stage positively correlates with Irish potato yield in Ireland. Lopez et al (1987) also stated that at bulking stage minimum temperature should not exceed 15^{o}c for

maximum yield, and that tuber decreases with increasing temperature at tuber bulking stage.

Furthermore, Kochalar (1991) reported that the minimum temperature of 15^{0}C is required for tuber bulking, while Ochigbo (1993) observed that low temperature is more conducive to tuber growth at bulking stage and economic tuber production occurs when the average temperature falls below 15^{0}C. More importantly, Ifenkwe and Okonkwo (1983) stated that, under irrigation, Irish potato production should coincide with the coldest month (November – January) so that the time of tuber bulking will coincide with the period of low temperature. Shimshe's (1986) finding corroborated this when he reported that once there is fluctuation in minimum temperature, it enhances rottenness and malformation in tuberization.

Results for the total growing season indicate that Irish potato yield is significantly correlated with two of the variables (rainfall in April and July) at 1% probability level. Rainfall in April has high correlation(r=0.599**) with Irish potato yield. This indicates that the higher the amount of rainfall in April, the higher will be the yield of Irish potato. It signifies the importance of rainfall during the sprouting to emergence/vegetative stage, which is a measure, to some extent, of the soil moisture available at emergence. During the raining season time of planting depends on the onset of rains (Ifenkwe and Okonkwo, 1983). In Jos-South, Irish potato is planted when rain becomes stable usually between the last week of April and first week of May. This result has collaborated Kowal and Andrew (1973) that the antecedent moisture status of the soil at planting is important for good germination or sustained growth of seedlings which may have effect on the final yield.

Rainfall amount in July, with a correlation coefficient of -0.665, also its high relationship with Irish potato yield, though negatively, at 1% level of significance. This indicates that, the higher the amount of rainfall in July, the lower the yield will be. This is not surprising because July coincides with tuber bulking /ripening stage. The higher correlation obtained in this study confirms the assertion by Zaag et, al (1981) that excess soil moisture at tuber bulking/ripening stage causes poor soil aeration and root damage which influence crop development and yield. It further confirms the work of Nwakocha (1987) that blight causes between 40-80% reductions in yield. The peak incidence is between July and August when the haulm of most susceptible varieties are destroyed by inciting pathogen *phythopthora*. The disease is accompanied by high relative humidity, dew and frequent rainfall (Hienfling 1987).

Table 2 : Results of Correlation of Climatic Elements with Irish Potato Yield at Various Phonological Stages

Climatic element	Sprouting to emergence/Vegetative	Tuber set/initiation	Tuber bulking/ripening	Total growing season
X_1=Total rainfall(mm)	0.332	0.470*	-O.122	O.333
X_2= max. Temp. ^{0}C	0.594**	0.202	0.412	0.250
X_3= min. temp. ^{0}C	0.548**	0.219	-0.616**	0.300
X_4= soil temp. ^{0}C	-0.041	-0.335	-0.097	0.362
X_5= Rainfall in April	-	-	-	0.599**
X_6=Rainfall in may	-	-	-	0.014
X_7= Rainfall in June	-	-	-	0.306
X_8= rainfall in July	-	-	-	-0.665**
X_9= rainfall in August	-	-	-	-0.391

** Significant at 1% r = 0.530 *Significant at 5% r = 0.430

c) Combine Effects of Agro-climatic Parameters on Irish potato Yield

The result of the bivariate correlation discussed above only depicted the isolated relationship between the climatic variables and Irish potato yield. It does not indicate the level of importance of such climatic variable influencing yield. Therefore, in order to identify clearly those climatic variables that are critical to Irish potato production, those five climatic parameters that were found to have contributed significantly during the three stages of growth were further subjected to step-wise regression analysis

Table 3 therefore, shows the result of the step-wise regression analysis. Only those climatic parameters which contribute significantly (at P< or = 0.01) to variation in Irish potato yield are included in the analysis. Two out of the nine observed climatic factors considered were found to have contributed significantly to the variation in the yield of Irish potato in Jos-South. These indices are rainfall in July and minimum temperature at tuber bulking/ripening stage. The two variables together accounted for 58.1% of the total variance in Irish potato yield in the area. Rainfall in July has the highest contribution of 44.25% to yield variation and minimum temperature contributed 13.85% to yield variation.

Table 3 : Step-wise Regression of the Agro-Climatic Parameters on Irish Potato Yield

Variables	Partial R^2	Model R^2	T	P > t	F - ratio
X_8 = Rainfall in July	44.25	44.25	2.86	0.01	11.78
X_3 = minimum temperature at tuber bulking stage	13.85	58.1	2.37	0.03	

IV. Conclusions

The conclusion drawn from the findings of this study is that total rainfall, maximum temperature, minimum temperature, rainfall in April, rainfall in July all correlate significantly with Irish potato at various stages of the crop's development. This means that the crop depends on these factors for better growth and yield. However, minimum temperature and rainfall in July are the most critical climatic element affecting the yield of Irish potato in the study area. These findings have underscored the importance of agro-climatic parameters as critical factors controlling crops growth and yield in Jos- South and in plateau State. It was also discovered that late blight disease contributes significantly in reducing the crop yield.

V. Recommendations

Based on the findings of this study, the following recommendations are presented:

i. The present planting period for Irish potato is found suitable and should be maintained. This will help to maximize the advantage of minimum, maximum temperature and rainfall in April for the sprouting to emergence or vegetative stage and minimum temperature at tuber bulking stage.
ii. More weather stations should be established in areas where none existed so as to facilitate generating climatic data all over the area to provide information for long term planning of agricultural development in the area.
iii. Late blight resistant varieties of Irish potato should be developed in order to eradicate late-blight diseases which reduce the yield of Irish potato.
iv. This study only considered basic climatic elements of rainfall, air temperature and soil temperature. Subsequent studies should encompass all climatic variables, especially the derived data such as onset dates of rains, dry spell or drought etc.

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Solid Waste Management; Clean India by Reduce Solid Waste

By Amit Bajaj & Vipan Kumar

Abstract - In India the solid waste increasing rapidly day by day due to increasing the living standards of human beings by leaps & bounds in India approximately last twenty years and due to increasing population. The handling of solid waste in India is not up to the mark. We always consider that it is a total waste thing, but if we reduce, reuse or recycle it becomes a very useful thing. The poor handling of solid waste cause of increases the pollution, human beings health, Rising global temperatures, animals, and many types of ecosystems and bad effect on environment. In this paper we describe that solid waste handling is not a single man work; it is the sole responsibility of all the human beings to maintain the balance of the ecosystem by proper handling the solid wastes. In this paper we also describe that the role of human being to reduce the solid waste and government of India.

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I. Introduction

a) Solid Waste Management

"Solid waste" means any garbage, trash, refuse, abandoned material, by products, scrap, ash, sludge, and all discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities. Solid waste is cause of pollution in two ways i.e. direct or indirect. In direct way pollution is land pollution and in indirect way pollution is Air and Water pollution.

Human and animal activities generate many wastes that are discarded as useless or unwanted. These are mainly solid and result in landscape pollution. Landscape pollution is the 3rd important pollution after Air and Water pollution. Landscape pollution is the 3rd important pollution after Air and Water pollution. And after land pollution, then this solid waste mixed with Air and Water then it becomes Air and Water polluting agent. The solid waste has adverse effect on the life of human being and environment. The solid waste reduces the aesthetic look of the city. The reasons of this effect is by common people who thrown solid waste openly in open space. In every city in India; the solid waste handling is very poor. The solid waste increased rapidly day by day in India due to increases in population and change in life style.

Authors α σ : Assistant Professor, Department of Mechanical Engineering G.T.B.K.I.E.T. Chappianwali Malout-152107, Punjab, India. E-mails : er.amitbajaj@gmail.com, vipan85@gmail.com

b) Types of Solid Waste

- Industrial solid
- Municipal solid waste (MSW)
- Hazardous, toxic, waste
- Construction waste
- Food processing waste
- Bio-medical waste
- Nuclear waste
- Agricultural waste

c) Process of Solid Waste Management

i. Primary Pollution and Waste Prevention

a. Change industrial process to eliminate use of harmful chemicals.
b. Use less of a harmful product.
c. Reduce packaging and materials in products.
d. Make products that last longer and are recyclable, reusable, or easy to repair.

ii. Secondary Pollution and Waste Prevention

a. Reuse.
b. Repairs.
c. Recycle.
d. Compost.
e. Bye Reusable and Recyclable product.

iii. Waste Management

a. Treat waste to reduce toxicity.
b. Incinerate waste.
c. Bury waste in landfills.
d. Release waste into environment for dispersal or dilution.

d) Objectives of Solid Waste Management

Solid waste becomes a dangerous thing if we are not handling it properly. It is directly cause of spread many types of disease, dirtiness and pollution. It is the main reason to destroy aesthetic look of our city. The main objective of solid waste management is to improve the quality of life. The objective of solid waste management is to reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste. This in turn results in lesser requirement of raw material and energy as inputs for technological processes. Such techniques and management programs have to be applied to each and every solid waste generating activity in a society to achieve overall minimisation of solid waste.

e) Drawbacks of the Present System

- Municipal Corporation is not doing their job properly in India.
- No proper storage system of waste at source.
- No system of primary collection from door to door.
- Irregular lane sweeping at.
- Waste storage depots have been a problem.
- Transportation of waste is not satisfactory in India.
- Poor handling of waste in India.
- Disposal of waste is a neglected area of SWM services and the current practices are grossly unscientific.
- No Awareness among people regarding the solid waste reduction.
- Lack of public participation.

II. Growth of Solid Waste in India

In India rapid growth of Municipal Solid Waste from 1990 to 2010 as shown in figure no:-1. The graph shows that the projected solid waste collection rising upto 235 Million Tonnes/ Year in financial year 2041. These rising line also shows that, how the Indian cities converted to dirtiness.

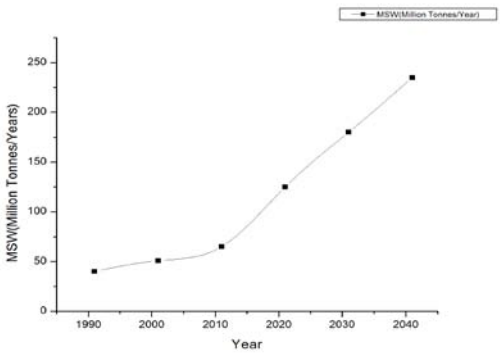

Figure 1

III. Literature Review

Cities in India with growing population, changing life styles, migration of people from rural areas to urban areas and rapid industrialization end up generating an enormous quantity of urban waste (Municipal Solid Waste - MSW) every day. By and large, the Municipal Bodies / Urban Local Bodies ("ULB") in various cities/towns collect MSW, transport it to the dump yards and dispose it off in open ground dumping or non-sanitary landfill. These landfill sites are an environmental hazard – emanating methane causing greenhouse effect, smell & dirt causing health problems, and leachate contaminating the ground water, etc.

The issue was taken-up by some NGOs in the Supreme Court, following which the MSW Handling & Management Rules 2000 have been framed. All the ULB's were directed by Ministry of Environment & Forests, Government of India (MoEF, GoI) to set up municipal waste processing facilities, however, not a single ULB could implement the directive because of various constraints. It is reported that most of the ULBs are getting summons from the Court of Law for not complying with Supreme Court directives for setting up municipal waste processing facilities and this has caused an urgency to support the ULBs for setting up such facilities. The challenges now being faced by solid waste management in China include reducing the quantity of waste from the source, promoting the recycling of solid waste, improving disposal levels and reforming solid waste management systems [1].Proper management of Bio medical waste is a concern that has been recognized by both government agencies and the Non government organizations [2].The existing dumping grounds are being used for construction of commercial and residential complex. Due to the chemical reactions below the ground, obnoxious gases emit throughout the year. However it is intensified during summer and affects the human health, damage sensitive equipments like computers, electronic devices etc. Our country desires to have a scientific method of disposal of Municipal Solid Waste [3].SWM, which was one of the most poorly managed civic activity, has transformed into one of the most well managed one [4].Proper treatment, storage prior to treatment or disposal and safe disposal of HWs is essential for environmental health [5].Proper treatment, storage prior to treatment or disposal and safe disposal of HWs is the need of the hour [6].Open dumping of solid waste affect the aesthetic value of the surrounding area of the disposal site. It also produces very bad smell at the time of decomposition process. At the time of decomposition it released a various gases within the surrounding area due to that air get polluted and this pollution leads to global warming [7].

Solid Waste if not disposed and managed properly, negative impacts will take over and kill the destination [8].The main challenge in applying MSW sorting at the source programs has to do with the correspondingly high level of citizen involvement in dispensing the different waste materials that comprise MSW into different waste bins, either inside or outside the household [9].MSW generation is over-riding the population growth in Indian mega-cities [11].The new and alternative building construction materials developed using agro-industrial wastes have ample scope for introducing new building components that will reduce to an extent the costs of building materials [15].In an optimistic view, the process of globalization may render the world's development more sustainable simply by pushing the world economy towards the decreasing part of the bell-shaped Environmental Kuznets Curve [16].PPP system focuses on processing of waste without improving the collection and transportation activities, which leads to a higher cost per ton of waste management [20].In most of the cities, the waste quantity is not measured and is usually assessed

based on number of trips made by transportation vehicles [23].There is a need to integrate the role of different stakeholders involved in waste management [25].A reliable approach is to be critical and creative; to start from the existing strengths of the city and to build upon them; to involve all the stakeholders to design your own models; and to 'pick and mix', adopt and adapt the solutions that will work in your particular situation [29].Agricultural utilization of MSWC is the most cost-effective MSW management option over traditional means such as land filling or incineration as it enables recycling of potential plants nutrients [33].

Measures must be taken to diminish leachate production and to monitor the groundwater of the surrounding area, even after taking remedial actions [49].

IV. Role of Human Being to Reduce Solid Waste

Everyday Solid waste is increase by human beings in every city by thrown waste in open space. These solid wastes include plastic, papers, cans, disposal, kitchen waste and rotted vegetables etc. This increases the dirtiness of the city and cause to increase pollution and diseases. We always blame public and government sectors to control pollution through controlling market mechanisms and government blaming people to avoid and check pollution. Who would control whom? Many ecologists and environmental scientists believe in that pollution problems can be overcome by using market mechanisms to reduce solid waste problems rather than rigid rules and regulations. Man could achieve this by identifying his own role at individual level in prevention of pollution. This is possible through environmental awareness, education and enlightenment. We are needs to search the most viable, efficient and economical ways to eliminate pollution problems.

Waste disposal at personal level should be optimally reduced as waste destruction by any means causes pollution. Timely disposal of waste to prevent decomposition of household refuge as to check foul odours and spread of disease by insects, flies and other pathogenic bacteria and service centres of vehicles should minimize the disposal of organic solvents into the main drains. So reduce the use of plastic bags and thrown waste by only in bins; if possible using different bins for different waste and also reduced the wastes by reducing the marriages party arrangements throughout the India. Another thing is that paper is not waste; if it used for recycled. We will redesign manufacturing processes and products to use less material and energy, redesign manufacturing processes to produce less waste and pollution. We can develop products that are easy to repair, reuse, remanufacture, compost, or recycle and eliminate or reduce unnecessary packaging.

If we will refuses the packaging where it should possible. And establish cradle-to grave responsibility. There is need for restructure of urban transportation systems and using e-mail or text messaging in place of paper mail. The news papers and magazines should be read online. The Reduction in office paper waste by implementing formal policies to duplex all drafted reports and by making training manuals and personnel information available electronically. The implementation of Work with customers to design and implement a packaging return program and Switch to reusable transport containers. There should be Reduction in office furniture and supplies, such as interoffice envelopes, file folders, and paper.

V. Problem Formulation

In our society people were not aware to use this type of solid waste and not get the proper education to handle them. Collection of solid waste are not proper; it is always collected in mixed way and collected place are not proper maintained. There are need to introduce technology and institution and regulatory the framework to handling the solid waste. Large metropolitan areas have the greatest difficulty dealing with solid waste. Nations with a higher standard of living tend to produce more municipal solid waste per person than less-developed countries.

- Over population
- Rapid Technology advancement
- Packaging materials
- Urbanization
- Lack of awareness
- Lack of public participation
- Poor enforcement of laws
- Lack of political will to properly enforce and comply with
- Lack of clarity and overlapping of competences of different public organs
- Lack of controlling and monitoring of entities in charge of waste collection facilitates corruption in WM at public and private levels
- Lack of involvement of citizens in the WM decision making process at public levels deters the identification of community concerns and needs regarding life conditions.

VI. Effects of Solid Waste on Environment and Living Beings

- GHGs are accumulating in Earth's atmosphere as a result of human activities, causing global mean surface air temperature and subsurface ocean temperature to rise.
- Rising global temperatures are expected to raise sea levels and change precipitation and other local climate conditions.

- Changing regional climates could alter forests, crop yields, and water supplies.
- This could also affect human health, animals, and many types of ecosystems.
- Deserts might expand into existing rangelands, and features of some of our national parks might be permanently altered.
- Some countries are expected to become warmer, although sulfates might limit warming in some areas.
- Scientists are unable to determine which parts of those countries will become wetter or drier, but there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils.
- Whether rainfall increases or decreases cannot be reliably projected for specific areas.
- Activities that have altered the chemical composition of the atmosphere:
- Buildup of GHGs primarily carbon dioxide (CO2) methane (CH4), and nitrous oxide (N20).
- C02 is released to the atmosphere by the burning of fossil fuels, wood and wood products, and solid waste.
- CH4 is emitted from the decomposition of organic wastes in landfills, the raising of livestock, and the production and transport of coal, natural gas, and oil.
- N02 is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels. In 1977, the US emitted about one-fifth of total global GHGs.
- Hazardous for worker who come in direct contact.
- Disease may transmit during handling and transfer of biological waste.
- Rats which invade refuse dumps for food can spread plague, salmonellosis etc
- Flies breed on refuse dumps and transmit many disease like bacillary dysentery, diarrhoea etc.
- Large scale epidemic of cholera, gastro intestinal diseases, jaundice, hepatitis etc. Result from contamination of soil and water bodies.
- Choking of drains and gully pits.
- Water logging results in breeding of mosquitoes in stagnant water.
- Undergo decomposition and befoul the air with obnoxious odours
- On burning produce smoke and cause air pollution, Global warming and can cause acid rain etc.
- Groundwater contamination from a waste disposal site.

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VIII. Conclusion

After the study we found that there is need for the cleanliness of Indian city. There is need PPPs projects and also need a cooperation of every people in city for cleanliness. And after study we also found that there is lot of weakness in common man and government employee to managing the solid waste. And there is need to follow the suggestion that described below.

1) There is need of reduction in occasion parties to solve the problem of food wastes.
2) Two bin systems are required in every Indian city for solid waste and Bins to be posted at frequent tourist destinations and market places, bus stands and bus stops. The collection of waste in the bins should be done regularly and the waste collected disposed of properly.
3) The Government plays a very major role in setting up MSW (Municipal Solid Waste) management plants, to support research and take action as necessary to implement rules and regulations relating to conservation and protection of the environment as it is fragile.
4) Dumping should be strictly controlled by night patrolling and proper precautions be taken since it is the disposal of solid waste.
5) There is need for implementation of 4R principles.
6) Municipal Solid Waste (Management and Handling) Rules 2000 should be strictly adhered to by every municipality.
7) Plastic bags for packaging should be banned and stopped where ever possible.
8) Environmental Audit to be conducted for Indian city.
9) Awareness programmes are held regularly to make the tourist and locals aware of the need to conserve and preserve the "Nature – Mother Earth".
10) Voluntary societies should be there which will take the initiative for awareness programmes and training to peoples for handling of solid waste. The example of such kind of society is GSWF, Sirsa (India).

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Migration to Big Cities from Coastal Villages of Bangladesh: An Empirical Analysis

By Mohammed Mamun Rashid

Abstract - This paper provides core understanding about phenomenon of migration to big cities from coastal villages of Bangladesh. It describes major push-pull factors, how migration contributes to reduce or increase vulnerabilities and impacts of migration. The paper also depicts lives and livelihoods scenario of five study villages. Livelihood sources of coastal communities particularly agriculture and fisheries are climate sensitive. This micro level study examines how coastal people perceive climate change on their various activities, cross-seeking it with scientific shape, and their responses to climate change. Findings reveal that many migrants are enforced to move in response to changes in conditions (or in their perception of conditions) at the places of origin.

Keywords : *climate change, coastal communities, migration, vulnerabilities.*

GJHSS-B Classification : *FOR Code: 770499*

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Abstract - This paper provides core understanding about phenomenon of migration to big cities from coastal villages of Bangladesh. It describes major push-pull factors, how migration contributes to reduce or increase vulnerabilities and impacts of migration. The paper also depicts lives and livelihoods scenario of five study villages. Livelihood sources of coastal communities particularly agriculture and fisheries are climate sensitive. This micro level study examines how coastal people perceive climate change on their various activities, cross-seeking it with scientific shape, and their responses to climate change. Findings reveal that many migrants are enforced to move in response to changes in conditions (or in their perception of conditions) at the places of origin. A bulk number of migrants are victim due to climate induced extremes. There is also no scope to ignore the man-made causes like sea piracy, pressure from moneylenders, social insecurity and so on. Moreover, it is complicated to draw line between voluntary and forced migration. Though it is needful to think deliberately whither migration, itself, is an adaptation strategy or just a failure of adaptation; but findings of this study prove that lack of shelter, unemployment, lack of adaptive cropping patterns, lack of capital, insufficient level of awareness and knowledge of climate change scenarios are the hindering factors to adaptation within these villages. Bangladesh has a comprehensive set of policy instruments especially to address climate change but these are not delivering supportive role to fence out migration due to weak institutional arrangements and insufficient initiatives for community based adaptation.

Keywords : climate change, coastal communities, migration, vulnerabilities.

I. Introduction

Migration from one area to another in search of improved livelihoods is a key feature of human history. Begum (1999) asserts that migration is not new to Bangladesh. In this country, large-scale movement of the population has been a feature for a very long time. Increasing population is not the only factor responsible for rural-urban migration in Bangladesh since evidence shows that the overall lack of opportunities, lack of development seems to be increasingly associated with the rural areas. Afsar (2000) cites that rural-urban which has played a key role in the rapid urbanization process of Bangladesh will continue to increase in scale, complexity and diversity. Young adults, men and women, illiterate and highly educated who have support from social networks in the places of destination will migrate to maximize income opportunities generated by the city and minimize risks of uncertainties in the places of origin. However, Bangladesh is already vulnerable to many gradual change phenomena of climate change as well as climate change related extreme events. United Nations High Commissioner for Refugees (UNHCR) states, "The impacts of climate change are already causing migration and displacement. People in the least developed countries and island states will be affected first and worst. Most people will seek shelter in their own countries. Some displacement and migration may be prevented through the implementation of adaptation measures. However, poorer countries are under-equipped to support widespread adaptation. As a result, societies affected by climate change may find themselves locked into a downward spiral of ecological degradation, towards the bottom of which social safety nets collapse while tensions and violence rise. In this worst-case scenario, large populations would be forced to migrate as a matter of immediate survival." Unfortunately, there is lack of adequate and reliable data on climate induced migration in Bangladesh. In general, there is also lack of comprehensive national data, union or sub-district based accurate figure and exact trends regarding rural-urban migration in Bangladesh. Based on primary research done by the author, this paper describes phenomenon of migration to big cities from coastal villages of Bangladesh. Migration is approached from the perspective of coastal communities. Though it is difficult to show trends of migration from whole coastal villages by only five village study but will provide evidence-based picture of migration in narrow scale. An attempt is made to pinpoint some characteristics of Bangladesh and lives and livelihoods scenario of coastal areas. Views and experiences of local people about climate change and its relationship with scientific research findings are administered to find out responses and adaptive measurements. This paper takes a closer look on climate induced forced migration and man-made causes that influence for migration decision. Vulnerabilities of migrants and family members have also been analyzed. A set of recommendations is given for consideration of policy makers.

Author : Project Coordinator of the Promoting Democratic Institutions and Practices (PRODIP) Project in the Community Development Centre (CODEC), Chittagong, Bangladesh.
E-mail : rashidmamuns@yahoo.com

II. Objectives of the Paper

This paper aims to understand the changing causes of migration and how climate change affects migration. It describes the pushing and pulling factors of migration to big cities, contribution of migration and conditions after migration in big cities. Therefore, there are three research questions that researcher is going to answer in this paper. These are:

1. What are the causes and nature of migration from coastal villages to big cities? How does climate change affect migration?
2. In what ways does migration contribute to reduce or increase vulnerability?
3. What are the conditions of lives and livelihoods after migration in big cities?

III. Data and Methods

This study has been conducted in five coastal villages of Chittagong, Laxmipur, Noakhali, Patuakhali and Barguna districts in 2009. Data collection was started on September 2009 through door to door visit of 1,489 households. Name of the selected villages under particular union, *upazila* (sub-district) and district are shown in Table 1.

Table 1 : Name of Selected Villages

SL	District	Upazila	Union	Village
1	Chittagong	Chandanaish	5 no. Barama	Modhyam Char Barama
2	Laxmipur	Ramgati	7 no. Char Alexandar	Shebagram
3	Noakhali	Subarna Char	5 no. Char Jubile	East Modhyabagya
4	Patuakhali	Kalapara	7 no. Latachapli	Mombipara
5	Barguna	Patharghata	3 no. Charduani	Kaliar Khal

The five villages were selected randomly. The main methods used in this research were observation of respondents, Focus Group Discussion (FGD), complemented with semi-structured interviewing. The questionnaire for household survey comprises address of household in the village, member of households, age, sex, educational qualification and ownership of land. The questionnaire also contains the queries about types and nature of migration, age, sex, marital status, education and occupation of migrants, the causes of migration, specific place (destination) of migration, job in big cities, communication with area of origin, use of money and vulnerabilities of family members in the village. Biographic case studies were documented to portray pains and pleasures of migrants.

a) Bangladesh and Coastal Communities

Geographic area of Bangladesh is 147,570 square kilometers. Total population of Bangladesh was 123.85 million in 2001 (BBS 2001). As per UNFPA, population of Bangladesh was 164.4 million in 2010 (UNFPA 2010). According to the provisional results of 2011 Population and Housing Census, the enumerated population on 15th March 2011 was 142,319,000 (BBS 2011). Approximately 25 percent of current population lives in urban areas.

Bangladesh is predominantly an agricultural country. Gross National Income (GNI) is US$ 645 in 2010 (WB 2010). Bangladesh ranked 129th, out of 169 countries, of the UN Human Development Index and has been improving over the last decade (HDR 2010). Based on the upper poverty line, in HIES-2010 incidence of poverty is estimated at 31.5 percent at the national level, 35.2 percent in rural area and 21.3 percent in urban area. In 2005, these rates were 40.0 percent at the national level, 43.8 percent in rural area and 28.4 percent in urban area. Based on the lower poverty line, in 2010 the incidence of poverty is estimated at 17.6 percent at national level, 21.1 percent in rural area and 7.7 percent in urban area. In 2005 these rates were 25.1 percent at national level, 28.6 percent in rural area and 14.6 percent in urban area (HIES 2010). An estimated 60 million people are living below the poverty line with a significant proportion living in households which are female headed, in remote areas, and consisting of socially excluded and other vulnerable people. Most of the labor force is engaged in informal low productivity and low income jobs (BSFYP 2011-2015).

Bangladesh has a coastline of 710 kilometers and an Exclusive Economic Zone (EEZ). There are different views on the delimitation of the coastal areas. The conventional view is that the land that is inundated by the high and low tides is called the coastal belt. There are total 19 coastal districts and 147 *upazilas* (sub-district). A total of 48 *upazilas* (sub-district) in 12 districts are defined as exposed coast and remaining 99 *upazilas* (sub-district) are termed as interior coast. Table 2 shows geographical coverage, households, population of coastal zone and comparison with mainland of Bangladesh. It is found that 28.32 percent of total populations of Bangladesh lived in coastal areas in 2001. At present, 26.71 percent of total populations live in coastal areas where they mostly depend on fishery, agriculture, forest, local transportation, salt production and so on for their lives and livelihoods.

The coastal zone is relatively income-poor in comparison to the rest of the country. Among the occupational groups, the incidence of poverty is the highest among agriculture laborers. Their wages are low

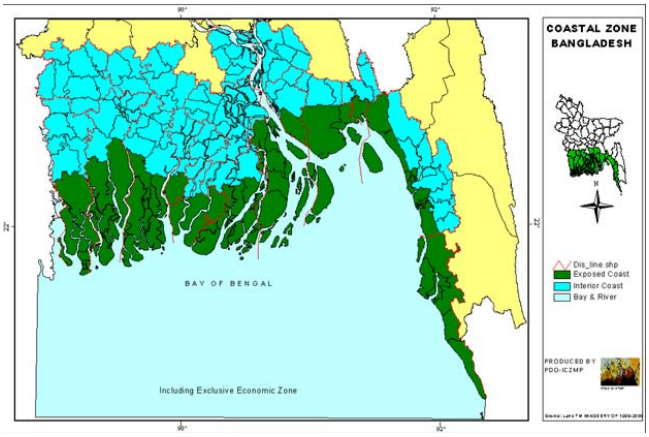
and employment is also not regular because of the seasonal character of agriculture. The proportion of the population below the officially acknowledged "extreme poverty" level (income below $1/day) is 29 percent in Bangladesh (World Bank 2003; Islam 2004). According to poverty map; trends of extreme poverty have increased and decreased as well in coastal sub-districts in between 2000 and 2005. But the situation in the coastal area remains disappointing, even in some areas poverty higher than 60 percent. Sixth Five Year Plan 2011-2015 of Bangladesh declared 21 districts as poorest districts in 2005. Out of them, seven are coastal districts like other districts of Rajshahi division. This national plan also listed 21 sub-districts as poorest sub-districts. Nine coastal sub-districts are included in these lists which are located in poverty pocket.

Table 2 : Area, Households and Population of Coastal Zone and Bangladesh

District	Area (km^2)	Households		Population	
		2001	2011	2001	2011
Bagerhat	3,959	321,640	354,700	1,516,820	1,461,000
Barguna	1,831	180,060	214,600	845,060	882,000
Barisal	2,785	475,680	509,800	2,348,440	2,291,000
Bhola	3,403	328,540	371,700	1,703,200	1,758,000
Chandpur	1,704	422,740	506,600	2,241,020	2,393,000
Chittagong	5,283	1,228,880	1,523,000	6,543,860	7,509,000
Cox's Bazar	2,492	294,460	417,700	1,759,560	2,275,000
Feni	928	213,040	276,800	1,205,980	1,420,000
Gopalgonj	1,490	217,440	247,300	1,151,800	1,149,000
Jessore	2,567	521,360	656,200	2,469,680	2,742,000
Jhalokathi	749	145,700	139,400	692,680	596,000
Khulna	4,394	494,800	546,400	2,357,940	2,294,000
Laxmipur	1,456	287,880	364,100	1,486,540	1,711,000
Narail	990	140,020	162,700	694,900	715,000
Noakhali	3,601	460,240	590,800	2,570,640	3,072,000
Patuakhali	3,221	280,980	346,900	1,464,800	1,517,000
Pirojpur	1,308	233,160	255,300	1,099,780	1,103,000
Satkhira	3,858	390,080	470,800	1,845,120	1,973,000
Shariatpur	1,182	213,240	247,800	1,080,680	1,146,000
Coastal Zone	**47,201**	**6,849,940**	**8,202,600**	**35,078,500**	**38,007,000**
Bangladesh	**147,570**	**25,307,600**	**32,067,700**	**123,851,120**	**142,319,000**
Percentage	**31.99**	**27.07**	**25.58**	**28.32**	**26.71**

Source : Population & Housing Census: Preliminary Results 2011 and Census 2001

Coastal areas of Bangladesh face with several natural disasters like cyclone, tidal, flood etc. In addition, there have man-made different disasters like arsenic, water logging and salinity in water & agricultural land. Now days the threat of cyclonic storm like *Sidr*, *Aila* and tidal wave and cyclone of 1970, 1991, 2007 and 2008 has become a permanent phenomenon in their life. Beside these, smaller storms and tidal bore occur almost every year. Every disaster brings about extensive loss of life and property. Still people are compelled to go to the sea for fishing during rough weather only for their survival or to meet the demand of moneylender. Depletion or degradation of the natural resources affects millions of people since majority of population depend on agriculture, aquaculture and fishing for their livelihood.



Map 1 : Coastal Zone of Bangladesh. *Source:* Islam M. Rafiqul (2004)

b) Study Villages

This study has been conducted in five coastal villages. Basic facts and figures are recorded at the time of village study. Characteristics of villages are given briefly in Table 3 which is ground of migratory outflow:

Table 3 : Characteristics of Villages

Village	Characteristics
Modhyam Char Barama	Area: nearly 1.50 square kilometers; No. of households = 270; Household members = 1,607; No. of landless households = 227. Major occupations: 42% agriculture and agricultural labor, 13% day labor.
Shebagram	Area: nearly 2.00 square kilometers; No. of households = 239; Household members = 1,410; No. of landless households = 214. Major occupations: 59% fishing, 11% agricultural labor, 8% day labor.
East Modhyabagya	Area: nearly 3.00 square kilometers; No. of households = 407; Household members = 2,376; No. of landless households = 328. Major occupations: 36% day labor, 32% agriculture and agricultural labor.
Mombipara	Area: nearly 1.20 square kilometers; No. of households = 221; Household members = 1,037; No. of landless households = 168. Major occupations: 33% agriculture and agricultural labor, 28% fishing.
Kaliar Khal	Area: nearly 2.50 square kilometers; No. of households = 352; Household members = 1,492; No. of landless households = 299. Major occupations: 56% fishing, 15% agricultural labor.

Most of the study villages are located in remote area where hardly any industrial development takes place. People have poor access to drinking water, health services and sanitation coverage. There is dearth of cyclone shelter. 1,236 households, out of total 1,489, are landless. The term 'landless' in Bangladesh does not necessarily mean being entirely without land and a household in this category can have up to 0.49 acres, that is, approximately 2,000 square meters (DAE 2007). However, 422 households have neither cultivatable land nor even homestead land.

c) Out Migration

Defining and classifying migration is no longer easy and straightforward. The traditional definition of migration, i.e. 'movement of people from one place to another, temporarily or permanently, in search of better life, livelihood, or, to avoid threat to life and livelihood', faces the challenge of incorporating the notion of transnationalism. New definitions of migration are required to embrace the simultaneous stay of a person in more than one space (Siddiqui).

Confusion was raised about calculation of existing households in the selected villages. During door to door data collection, different nature of migrations was discovered. A section of migrants lose their homestead, assets or sell those and usually do not come in village and in many cases their neighbors or relatives do not know their destination. Few of such section of migrants occasionally come in village. Simply, they were not included during calculation the number of households in the village. On the other hand, a group of migrants who live in town or city with whole family but house in village is usually locked or looked after by domestic worker, neighbor but they come in village occasionally or certain intervals. Moreover, some migrants are somehow settled at destination by marriage or other means but their family circle live in village. Many of them are voters at their destination. It was a confusion to include them or not during households and population calculation. Union Parishad (UP), lowest tier of administrative unit in Bangladesh, would like to characterize it as settlement in town or city rather than permanent migration. Union Parishad (UP) also advised to include them under respective village and judged that they have address in village. Therefore, the applied definition of permanent migration from the village refers such households who lose, sell (or other mode) their homestead i.e. simply do not have homestead in the village and do not live there also.

Seasonal migration refers migration for one to four months with seasonal work purpose. The duration of seasonal migration vary on nature of work and also has variation considering the characteristics of different areas. Therefore, the standard duration of seasonal migration has been fixed-up through consultation with participants in FGD. It is also found that some migrants relocate from village to do higher study, white or blue color job, and to be self-employed in town or city. Majority of them live at dormitory or rented house and family members living in village. Though it is very difficult to make boundary line between permanent migration and settlement and other classifications, but it has been done from thoughts of local people. This paper makes scope of wider discussion and quite flexible for re-classification. Table 4 shows village-wise migration picture.

Table 4 : Village-wise Statistics of Migration

Categories	Modhyam Char Barama	Sheba Gram	East Moddambaga	Mombi para	Kaliar Khal	Total	%
Households	270	239	407	221	352	1,489	-
Permanent migration	36	141	14	17	29	237	-
Settled in town or city	4	3	39	10	38	94	-
Seasonal migration	1	61	121	46	56	285	19%
Migration for regular work or study	19	6	6	13	9	53	4%

It is very difficult to find out actual figure of permanent migration due to lack of proper information. One respondent told in Bengali, "*Ami Janina Amar Protibeshi Gram Chere Kotai Chale Geche"* (I do not know where my neighbor goes away from the village). However, a total of 237 households permanently migrated from the village during last one year, i.e., 2008-2009. Seasonal migration is controlled by an extended period of low labor demand in the home village, combined with alternative and accessible labor demand elsewhere. A total of 476 migrants from 285 households migrate seasonally from the village. The rate of outflow from the villages is not same with inflow in big cities because some migrants move to sub-district centers, small towns, outskirts and richer villages. As for example, only 39 households, out of river eroded 141 households, of Shebagram village migrated to Chittagong and Dhaka city. Others migrated to nearby villages for immediate shelter and still find out hope of source of income. Majority of seasonal migrants go to Dhaka and Chittagong city. Destination and occupation of seasonal migrants are not static in nature. One year some seasonal migrants work at brickfield which is not so far from the village but in another year same people go to big city to work at restaurant or for rickshaw pulling. Even nature and types of work of day labor is changed within a week. However, it is proved that majority of migrants are pouring to big cities. A large number of women and adolescent girls migrate from respective village. They usually come in city through contact with relatives or neighbors. As for example, elder sister brings her younger sister or cousin. Sister brings the wife of her brother or sister-in-law. Aunt brings nephew, one brings her ex-classmate who drop out from school. Such mixing relationships are found that is used as a social capital to come in the city and secure job at garments factory. It is apparent that more girls and females are migrating now and not just as accompanying spouses. As for example, total 107 members from 38 households of Kaliar Khal village migrate to Chittagong city, Dhaka city and nearby areas. Out of them, 85% go to Chittagong city and most of them are female and girl. They work in garments factory and live at Kalshi Dighir Par, Pre Port, Chittagong. It is happened due to economic hardship, demand of female labor, cheap labor, growing social acceptance of women's economic independence and mobility. They mainly live at rented house in city but bulk number of relatives and neighbors of village are living in cluster. They are used to sharing food, practice own language and culture in city. There is little chance to back of such migrants to the village.

d) Push Factors

Push factors are differed from village to village. As for example, river erosion is the main push factor of permanent displacement from Shebagram and Modhyam Char Barama village. But this factor does not work in rest of the villages. Unemployment for a particular period is another push factor of seasonal migration. Lack of employment during *jatka* (juvenile hilsha fish) preservation period i.e. from *Kartik* (October-November) to *Baisakh* (April-May) is main cause for seasonal migration of people who mostly depend on fishing. Unemployment during *Kartik* (October-November) to *Jaistha* (May-June) is the main cause of seasonal migration from east Moddambaga village where most of the people are engaged in agricultural work. Agricultural poverty (of which lack of cash crop is often a sign) stimulates migration. However, major push factors found in this study are losing homestead and cultivatable lands due to river erosion, natural disasters, sea level rising, plunge of low land, water logging, drainage problem, salinity, depletion of fishing resources, low yield in agricultural lands, decreasing the productivity of per labor in agricultural sector, single crop production, destruction of crops by natural calamities, lack of knowledge to cultivate climate change adaptation crops, tortured by sea pirates, vicious cycle of *dadander* (moneylender), pressure from few NGOs to repay loan, no hope in village, food insecurity, inadequate access to *khas* (government) land and resources, very little access to safety nets program and so on.

e) Climate Change

Temperature, rainfall, wind pattern and solar radiation mainly characterize the climatic systems of Bangladesh and determine the seasons (Islam et al., 2010). Brammer (2002) and Islam et al. (2010) classified Bangladesh into four distinct climatic seasons. These are: 1) Pre-monsoon (March to May) with high temperatures with high evaporation rates, 2) Monsoon

characterized as hot and humid period with decreasing rainfall, and 4) Dry or winter seasons (December to February) portrayed as the coolest, driest and sunniest period of the year. Bangladesh is at the risk of climate change. The average rate of heat of Bangladesh increased over the last 14 years (1985-1998) and in May it is 1°C and in November it is 0.5°C increased. Soil salinity increased and as a result, 830,000 hectares cultivable land have been affected. Severe floods have been repeated in 2002, 2003, 2004 and 2007. The number of cyclones in the Bay of Bengal has increased. In dry and hot summer, salt water from the sea enters within the mainland up to 100 kilometers. By 2050, the productions of rice and wheat will decline by about 8% and 32%, respectively (against a base year of 1990). The impacts of climate change on Bangladesh have significant implications for its development because reliance of many livelihoods on climate sensitive sectors, particularly agriculture and fisheries (AR4 2007).

Migration occurs in response to multiple pressures, and it is difficult to isolate environmental pressures from ongoing economic ones. Issues and concerns of climate change have been portrayed, in nutshell manner, through views of local people and coinciding with secondary research findings for scientific validation. Climate change affects on lives and livelihoods at study villages and breeding causes of migration.

Local people opine that the environment has been changing over the years. Salinity intrusion deteriorates water quality. Drainage congestion and water logging are common in these villages. Villagers perceive that increasing of salinity may make saline desert in the arable lands. They also state that there has been changed in seasonal rainfall pattern. Rainfall is erratic. Temperature has been increased over the years. FGD participants of Mombipara and Kaliar Khal village told that during cyclone *Aila* water entered into village and flow of water was higher than the height of embankment. Root of trees beside embankment became weak due to long time staying of water and it washed soil from lower domain. Such episodic inundations by cyclones turn arable lands of the village into water-logged areas. The village is not properly protected by embankment. On 15 November 2007 and 25 May 2009, cyclone *Sidr* hits the southern coast and cyclone *Aila* swept across the south-western coastal belt of Bangladesh respectively. The scale of the damage caused by *Aila* is much larger than the damage caused by cyclone *Sidr*. Cyclone *Sidr* had damaged homes, crops, and livestock overnight. But *Aila*, with its stagnant, saline flood waters, is like a slow poison that is steadily, but surely, killing vegetation, fish and fruits, destroying arable land, and leaving behind a trail of homeless, internally displaced people whose homes have either been water-logged, completely inundated, or destroyed by the flood and livelihoods- their assets and occupations- have been destroyed.

FGD findings are differed from village to village. Participants of Modhyam Char Barama and Shebagram village are extremely concern on permanent displacement due to river erosion. Intrusion of saline water, severe salinity, drainage congestion, wetness and water logging are major problems of Mombipara and Kaliar Khal village. Production of crops like groundnut, chili, watermelon and mustard is declined. Scarcity of irrigation water, drought, drainage congestion and water logging are major problems of East Modhyabagya village. Pulse crops (soybean, *mungbean* and *khesari*) are affected. BCAS (2010) research findings reveal that there is an increasing trend of maximum and minimum temperature both in *rabi* and *kharif* seasons affecting the cultivation of *rabi* crops in Noakhali and Patuakhali districts. Changes in temperature during 1975-76 to 2005-06 in coastal districts are considered for analysis. During same period, the decreasing trend of rainfall in *kharif* season affects the cultivation of rain fed crops. But increasing trend of rainfall in *rabi* season favors the cultivation of *rabi* crops in Patuakhali district. Total rainfall pattern in *kharif* season is decreasing that affects the cultivation of rain fed crops in Noakhali district. Scientific research findings are harmonized with views of local people.

Climate change has effect on river erosion and displacement of the villagers. Climate change is likely to increase rainfall in the Brahmaputra-Ganges-Meghna basin in the monsoon season. This will result in higher river flows and possibly increased velocities. This is likely to cause further instability in the already unstable river system. Higher rainfall in upper catchments may also cause increases in sediment movements. Overall, river systems are expected to become more unstable as a result of climate change. River bank erosion is likely to become more frequent (BCCSAP 2009). River erosion is one of the causes of displacement of many households from two study villages.

Climate change has direct and indirect adverse effect on fish flora and fauna for their reproduction, migration and survival. During last two decades *hilsha* production from inland water declined about 20%, whereas marine water yield increased about three times. Major *hilsha* catch has been gradually shifted from inland to marine water. *Hilsha* fish ascend for spawning migration from sea into estuaries and most of the river systems of Bangladesh. Where, all the essential exogenous semi-saline or freshwater ecological parameters trigger the reproduction of *hilsha* parental stocks. The river water nurses the millions of larvae where they grow and revert to juvenile and adult *hilsha*. At that stage they again migrate towards the sea. But the recent siltation problem on the upstream part of Padma and other river systems affected the normal course of spawning and migration of the fish. Availability

of *hilsha* stock is gradually declining in the Padma and Meghna River catchments areas. As a result, the trend of *hilsha* production in the rivers has been decreased and alternatively, the production trend in marine water as mentioned above has comparatively been increased (M.G. Hussain et al., 2010). It is reported from the fishermen that they must generally travel much further from their village to make their catches.

It is complicated to draw line between voluntary and forced migration. Migration of student for higher study is voluntary in nature. But displacement due to river erosion is forced migration. Though it is needful to think deliberately whither migration, itself, is an adaptation strategy or just a failure of adaptation; but it is noted that lack of shelter, unemployment, lack of adaptive cropping patterns, lack of capital, insufficient level of awareness and knowledge about climate change are the hindering factors to adaptation within these villages.

f) Pull Factors and Vulnerabilities

Population of Dhaka city corporation is 5.40 million, Chittagong city corporation is 1.99 million and Khulna city corporation is 0.78 million respectively (BBS 2001). However, as per different sources present population of Dhaka city shows more than double of 2001 census. As for example, the report title as "Dhaka: Improving Living Conditions for the Urban Poor" mentions that the population is currently around 12 million and is projected to grow to 20 million in 2020, making it the world's third largest city. Approximately 25 percent of Bangladesh's current population lives in urban areas. Of this urban population, more than half lives in the four largest cities: Dhaka, Chittagong, Khulna and Rajshahi. The population density is now believed to have reached around 34,000 people per square kilometer, making Dhaka amongst the most densely populated city in the world (BSFYP 2011-2015).

It is found that permanent migrants migrate to seek shelter and employment opportunities in big city though pull factors do not significantly magnetize them. Searching employment opportunities; whatever odd, irregular or underpaid, is the main pull factor of seasonal migration because people do not have ample employment opportunities round the year in village. Moreover, scope of employment particularly in garments factory, dream of better living conditions, communication with relatives living in city, social networks, access to facilities and amenities such as higher education and better medical care are other forms of pull factor. Two cases of migrated households are given herein for an idea about lives and livelihoods picture in Dhaka and Chittagong city respectively.

i. *Let Case: 1*

a. *Background*

Name: Majeda Khatun; Husband's Name: Panu Miah; Father's Name: Ali Hossain Faraji; Mother's Name: Jobeda Bibi; Address: Mombipara, Latachapli, Kalapara, Patuakhali; Age: 30 years; Educational Qualification: III; Marital Status: Married; Children: 03 daughters; Occupation: Business; Nature of Migration: Permanent; Place of Migration: Dhaka City.

Majeda Khatun migrated from the village to Dhaka city in 2007. She lives in Notun Bazar slum. Her husband and three daughters also live with her. She has old mother, five brothers and five sisters. They live in village.

She says, "My husband was a day labor in the village. He also involved in rickshaw-van driving, fish fry collection and agricultural work. I used to make handicrafts in the village. We realized that, day by day, it was becoming very difficult for us to live in the village due to low income. I took loan from an NGO but failed to repay installment on time. Then we decided to migrate from village to search better earning option."

After migration in Dhaka city, Majeda Khatun started work in Boroitola brickfield as a day labor. Her husband was also employed in the same brickfield. They rented one house in Notun Bazar slum and still living in the same house. They have to pay monthly Taka 1,200. She says, "Environment in slum is worse than village though our house was on *khas* (government) land i.e. outside of embankment. Slum is densely populated and rapidly proliferating due to migration from village. Sometimes people are killed by cutting under train. There is also serious crisis of drinking water."

Now Majeda Khatun has small tea stall in slum i.e. beside rail line. She sells tea, biscuit, cigarette and betel leaf. Her husband works as a day labor i.e. loading and unloading goods in the truck. Her elder daughter, Aklima, works in a garments factory. She says, "I came to Dhaka with my parents. I work in a garments factory and earn Taka 1,600 monthly. My parents encouraged me to work in garments factory. I give some of my earning to my parents and the rest I spend for myself."

Elder daughter of Majeda Khatun read up to class two in village and now works in a garments factory. Other two daughters do not go to school. Majeda Khatun says, "After few years they will be sent to garments factory or employed as housemaid." She also mentions that the environment in village is better than the city but has limited scope of job opportunities. That's why they migrated from village to Dhaka city.

b. *Learning*

Though the environment of the village is better than the city but due to limited scope of job Majeda Khatun and her family migrate from the village. The reality of squeezing employment scope due to environmental degradation enforces them to leave the village. To survive with city struggle, Majeda Khatun runs a tea stall; her husband is employed as a day labor and elder daughter works in a garments factory. She has

also planned to send younger daughters in garments factory.

ii. *Let Case: 2*

a. *Background*

Name: Abul Kalam; Father's Name: Late Abdul Mannan; Mother's Name: Late Tahera Khatun; Address: Shebagram, Char Alexandar, Laxmipur; Age: 29 years; Educational Qualification: Illiterate; Marital Status: Married; Children: 04 sons and 02 daughters; Occupation: Rickshaw pulling; Nature of Migration: Permanent; Place of Migration: Chittagong City.

Abul Kalam is a rickshaw puller. He migrated along with whole family members to Chittagong city in 2008. Now his family members live in very low quality house like a temporary thatched shack beside the canal of fishery *ghat* (landing centre), Chittagong.

Occupationally Abul Kalam was a fisherman. He lost three acres land by erosion of the Meghna. He says, "I shifted house three times due to erosion. My family members lived on other land after losing assets. Erosion changes everything; our home, livelihood and the society as well. River erosion is the curse for us." He has four sons and two daughters. His elder son (20) was a day labor in village and now working in fishery *ghat*, Chittagong. His second (17) and third son (14) dropped from school due to migration and not doing anything in city. Elder daughter (11) also dropped from school. Other son and daughter are under aged.

Abul Kalam had a small boat of *hilsha* net, which was broken down by the devastation of cyclone *Sidr*. He was also attacked by sea pirates. After losing his homestead for the last time, he decided to migrate with all of his family members to Chittagong city. He says, "We are erosion victim. We are landless and aimless. River not only erodes our lands but also our lives. We do not get access in *char* (lands accreted by the river sediment). There are the land dacoits and illegal grabbers."

After migration to Chittagong city, they started living in one house beside the canal which is adjunct to the river Karnafully. The house is elevated above the water flow and debris. More than 20 households share hanging latrine. Garbage, along with excreta, is dumped in canal which congests sewage system. Moreover, low laying area is submerged during tidal surge of the Karnafully. Rats and cockroaches scurry across the floor of the damp, dark and poorly-ventilated room.

Abul Kalam earns Taka 250 to 300 daily. He has to pay Taka 70 per day to owner as a rent. He changes his profession from fisherman to rickshaw puller. Though he found pulling the rickshaw quite hard on his body, he is now used to it. His income is not regular because rickshaw pulling depends on physical strength. He is not able to admit his children (dropped from school of village) into school due to extreme poverty.

The dream and life of Abul Kalam has been shattered due to river erosion. He survives in big city; however still he is dreaming about a good shape of life for his children.

b. *Learning*

Once Abul Kalam was a fisherman but river erosion compels him to change his profession. He shifted his house three times and at last he permanently migrates from the village. Now his family members live in a temporary thatched shack in Chittagong. Once he had a dream to educate his children but now his dream has been shattered. Climate change induced erosion changes everything; home, livelihood, society and fall them in vulnerable condition.

Neighbors do not know address of many displaced people. Uprooting is their main vulnerability. Displacement after extreme climatic event i.e. river erosion increases vulnerabilities in social disruption, unemployment, mental unrest, economic burden and uncertainty. Many displaced people migrate to big city along with limited cash and kinds. Sometimes they have only wearing cloth and nothing else. Even, no transport fare. Hope of survival, by any mean, in big city is their capital. Most of them live in slum, low rented house, polyphone-made house beside railroad and street. Permanent migrants usually do not have tie with place of origin.

Migrants are changing profession. As for example, fisherman of the village works as a construction helper in city. They face difficulty in finding employment with a limited skill set. It is found that new migrants who were boatmen in village now pulling rickshaw in city without skill and knowledge on traffic management. It creates fatal accident and disrupts quality of city life. They are also involved in informal nature workings and deprived from entitlements of fundamental rights.

Seasonal migrants generally send remittance. Remittance of majority of migrants is mostly used for daily expenses. They also use money for education of children, health, dowry, loan repayment and investment. However, it is viewed as a pillar which tackles the earning vulnerability in times of serious economic hardship. 43% of seasonal migrants, fishermen, are able to save and invest money for repairing boats, buy nets and other means to catch fishes when they get back in village especially at *hilsha* season.

Majority of migrants are facing exploitation in city especially female and children who are employed at unhealthy environment. The female and adolescents are also physically and mentally tortured and sexually abused at work place and living surroundings. Most of them live at low rented house or slum; even on footpath where have serious problem regarding water supply, sewerage, sanitation, electrification and other basic utilities. However, earning and living condition of few

migrants, who are employed in white color job and self-employed, in city is at satisfactory level.

Migration also adds vulnerabilities for sending family, community and others. Some of married migrants start a new family at new destination and thereby use earnings for them rather than family at village. They gradually cut their ties with their family staying in village. The absence of migrants has negative impact on social work of village and security of sending family. Migration of parents, make possibility to drop outs of children from school. When male are irregular to send money to village then it is very difficult for women and children to manage money. They fall in food insecurity, malnutrition and harassment.

IV. Conclusion

Pushing and pulling features of migration regarding poor and rich people are different. Migration of poor people is mostly influenced by immediate shelter and source of income.

This paper concludes that trend of migration from coastal villages to big cities is sharply increasing. It is putting pressure on the city's limited land, an already fragile environment, and weak urban services. New challenge has been emerged in small town and urban growth centers. Climate induced extremes forced many people to migrate in big cities and it seems to be refugee within their own beloved country.

V. Recommendations

Socio-economic conditions of coastal communities are different from mainland of Bangladesh. Coastal zone is relatively income-poor in comparison with rest of the country. Some districts and sub-districts are located at poverty pocket that were identified by the Government of Bangladesh. Holistic initiatives should be taken rather than scattered courses of action. Public expenditure in infrastructure and human development, access to financial services and creation employment opportunities in coastal villages can only fence unsolicited out migration. Major recommendations are:

1) Keep special budget allocation and fund for coastal communities especially for food security, health and infrastructure.
2) Bangladesh Climate Change Strategy and Action Plan (2009-2018) should be implemented through proper consultation with coastal people and respective stakeholders.
3) Bangladesh Climate Multi Donor Trust Fund (MDTF) and Climate Change Resilient Fund should be properly utilized as per prioritized six pillars set at Strategy and Action Plan (2009-2018).
4) Small-scale industries should be established in towns located beside coastal areas for creating alternative employment of poor people. Fish processing and preservation industries can be established.
5) Number of cyclone shelters should be increased in risk-prone areas. These shelters should be utilized for multipurpose.
6) As per action of Strategy and Action Plan (2009-2018), comprehensive assessment should be undertaken on climate change and its impacts on out-migration.
7) Awareness program should be undertaken about impact of climate change.
8) Research innovation like BR-47 (saline tolerant), BR-44 (water stagnant tolerant), and other climate resilient crops should be extended to grassroots people.
9) Vulnerable Group Feeding (VGF) and Vulnerable Group Development (VGD) cards should be properly allocated for real vulnerable people.
10) Alternative employments should be created during *jatka* (juvenile hilsha fish) catching banning period. The rehabilitation of fishermen should be ensured rather than providing little bit cash and kind support.
11) Housing structure in coastal areas should be changed considering risks of climate change.
12) There must have integrated and long-term (approximately 10 years) development plan for coastal areas of Bangladesh in the light of its prospects and problems. It should be mainstreamed with national planning documents.

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Impact of Regional Disparities on Agricultural Development in Uttar Pradesh- A Geographical Analysis

By Dr. Shafiqullah
Muslim University, India

Abstract - The present paper is an attempt to analyse the spatial patterns of regional disparities, variations in the levels of agricultural development and casual relationship between agricultural development (dependent variable) and selected variables of regional disparities (independent variables) among the districts of the state of Uttar Pradesh. The study utilizes published data obtained from Census of India and other statistical records at district level. Some standard statistical techniques are used in the present Study. The district has been taken as a smallest unit of the study.

Keywords : *regional disparities, relationship, developpment, variables, agricultural development.*
GJHSS-B Classification : *FOR Code: 070102*

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I. Introduction

Since the beginning and till now agriculture has remained the chief source of livelihood for million of masses worldwide. It provides not only the food to the teaming billions of the world but also a number of indusial raw materials. Agriculture plays an essential role in the process of economic development of less developed countries like India. Agriculture sector is the mainstay of the Indian economy, contributing about 15 per cent of national Gross Domestic Product (GDP) and more importantly, about half of India's population is wholly or significantly dependent on agriculture and allied activities for their livelihood (GOI, 2011). Nevertheless, agriculture remains a major source of employment, absorbing about 52 per cent of the total national work-force in 2004-05, down from about 70 per cent in 1971. The large population of India puts an ever-increasing pressure on the agricultural resources. It has caused frequent shortages of food-stuffs and other agricultural products in the country.

Since independence India has made much progress in agriculture. Indian agriculture, which grew at the rate of about 1 per cent per annum during the fifty years before Independence, has grown at the rate of about 2.6 percent per annum in the post-Independence era. For the overall development of Indian agriculture, many institutional and infrastructural changes have been introduced since Independence. Broadly, agricultural policy followed during this period can be distinguished in four phases: first phase considered from 1947 to mid sixties, second phase considered period from mid-sixties to 1980, third phase included period from 1980 to 1991, and forth phase includes period from 1991/92 onwards.

The first phase of agricultural policy witnessed tremendous agrarian reforms, institutional changes, development of major irrigation project and strengthens of cooperative credit institution. The Community Development Programme, decentralised planning and the Intensive Area Development Programmes were also initiated. The second phase in Indian agriculture started in mid 1960s with adoption of new agricultural strategy (Green Revolution). The new agricultural strategy relies on high-yielding varieties of crops, multiple cropping, the package approach, modern farm practices and spread of irrigation facilities. The biggest achievement of this strategy has been attainment of self sufficiency in foodgrains (Rao, 1996). The next phase in Indian agriculture began in early 1980s. This period started witnessing process of diversification which resulted into fast growth in non-foodgrains output like milk, fishery, poultry, vegetables, fruits etc which accelerated growth in agricultural GDP during the 1980s (Chand, 2003). (Mishra and Chand, 1995; Chand, 2001). The fourth phase of agricultural policy started after initiation of economic reform process in 1991. During this period opening up of domestic market due to new international trade accord and WTO was another change that affected agriculture. New Agricultural Policy was launched by Indian Government in July 2000. This aims to attain output growth rate of 4 percent per annum in agriculture sector based on efficient use of resources (Chand, 2003).

As a result of the new programmes and policies all the parameters of agriculture have undergone significant changes. The net area sown has increased considerably and the gross cropped area has almost doubled. The irrigated area has increased, wastelands have reclaimed and the area under the forest and other cultivable waste has declined. Cropping patterns have been changed. Coarse grains are being replaced by fine grains.

But due to variation in physical and socio-economic conditions, these changes in agriculture are not uniform all over the country either spatially or temporally. Uttar Pradesh has suffered from regional disparities and inequality even after six decades of

Author : Department of Geography Aligarh Muslim University, Aligarh. E-mail : shafiqullah4@rediffmail.com

independence. Some of the regions of this state are very backward and the abode of the largest proportion of poor in the country. The economy of the state is characterized by very sharp variations at the regional and district levels. Generally the state is divided into four economic regions, namely (i) Western Uttar Pradesh (ii) Central Uttar Pradesh (iii) Eastern Uttar Pradesh and (iv) Bundelkhand. All these regions have different climatic conditions, soil types and infrastructural development. The Western and Eastern regions are the most populous, with a share of 37 and 40 per cent respectively in the State population. About one-fifth of the population lives in the Central region, while only 5 per cent lives in Bundelkhand. Population pressure is much higher in the three plains regions. Western region is relatively the most developed region of the State in terms of economic prosperity. The region has a more diversified economy with almost half of the industries in the State are located in this region. NOIDA and Ghaziabad districts located in this region are emerging as the industrial hub of the State. Central Uttar Pradesh falls in the middle category in terms of economic development. It was industrially more developed with Kanpur as a major textile centre of northern India. The other two regions namely, East Uttar Pradesh and Bundelkhand are officially designated as backward regions. Eastern region is most densely populated with a heavy dependence on land. It is marked by low level of diversification, low productivity and low per capita income. Most of the poor in the State are concentrated in this region. Bundelkhand region has distinct natural characteristics and has much lower irrigation intensity as compared to other regions. It has lagged landless population and had high incidence of poverty. Within all the regions sharp intra-regional disparities are found at the district level.

Several eminent scholars have explained the need for measuring and explaining regional variation on agricultural development and have adopted different approaches. Although considerable amount of work has been done to study the impact of regional disparities on agricultural development both national and International levels, hardly any systematic attempt has been made in this field at the district level.

Keeping these observations in view, in the present study an attempt is made to study the impact regional disparities on agricultural development in Uttar Pradesh.

II. Objectives of the Study

The present study has been under taken with the following specific objectives:

1. To examine the geographical patterns of regional disparities in Uttar Pradesh.
2. To access the regional variation of levels of agricultural development.
3. The relationships between agricultural development (dependent variables) and selected indicators of regional disparities (independent variables).

III. Data and Methodology

The study is essentially based on secondary data relating to regional disparities and agricultural development that has been collected mainly from published works and reports namely Census of India, Registrar General, Govt. of India, New Delhi, Statistical Abstract of Uttar Pradesh, Economic and Statistics Division, State Planning Institute, Uttar Pradesh, Lucknow. The district has been taken as unit of analysis. In order to get the indexes of agricultural development the following 14 indicators have been selected after carefully examining their degree of importance in determining the agricultural development in Uttar Pradesh.

1. Total cropped area,
2. Percentage of net sown area to total reporting area,
3. Area sown more than once,
4. Cropping intensity,
5. Percentage of gross irrigated area to total area,
6. Percentage of net irrigated area to net sown area,
7. Irrigation intensity,
8. Person / Cultivated area,
9. Average size of land holding,
10. Consumption of fertilizers Kg/ha,
11. No. of Tractors / 1000 ha. of cultivated land,
12. Average yield of food grain,
13. Percentage of agricultural workers,
14. Percentage of cultivators.

Twenty six (26) variables have been taken to measure the levels of regional disparities among the seventy districts of the state (Table -4).

For analyzing the data 'z score' or Standard Score Additive Model has been used to arrive at the general level of agricultural development and regional disparities for the districts of the state. This is very simple in calculation but is the most appropriate in its results. For the 'z score' Smith (1979) has given a formula:

$$Zij = \frac{Xij - \overline{Xi}}{\delta Xi}$$

where:

Zij = Standardized value of the variable i in district j.
Xij = Actual value of variable i in district j.
$\overline{X}$ = Means value of variable i in all the districts
δXi = Standard deviation of variables i in all districts.

In order to asses overall level of agricultural development and regional disparities, the result of standard scores obtained for all indicators are added district wise and the average is taken out for these

indicators which is known as Composite Score (CS) for each district and algebraically expressed as:

$$C.S. = \frac{\Sigma Zij}{N}$$

Where:
C.S. = Composite Score, N = No of variables,
Σ Zij = 'z' score of all variables i in district j.

All data have been arranged into descending order and standardized to zero mean for interpretation. The positive values show high level of socio-economic development and the negative values indicate the low level of socio-economic development.

a) Study Area

Uttar Pradesh is situated in the northern part of India. It lies between lat 23° 78' and 30° 24' N and long 77° 05' and 84° 38' E sharing International border with Nepal. It is surrounded by Bihar in East, Madhya Pradesh in south, Rajasthan, Himachal Pradesh, Haryana in the West, and Uttarakhand in the North. Nepal touches the northern borders of the State (Fig. 1). It covers an area of 24.09 million ha, which constitute about 7.3 per cent of the country's geographical area. After the creation of Uttarakhand, UP's forest area declined from 5.2 million hectares to 1.69 millions hectares, creating a serious imbalance. Today, even the 5 per cent of the total area which is under forest has suffered extensive environmental degradation.

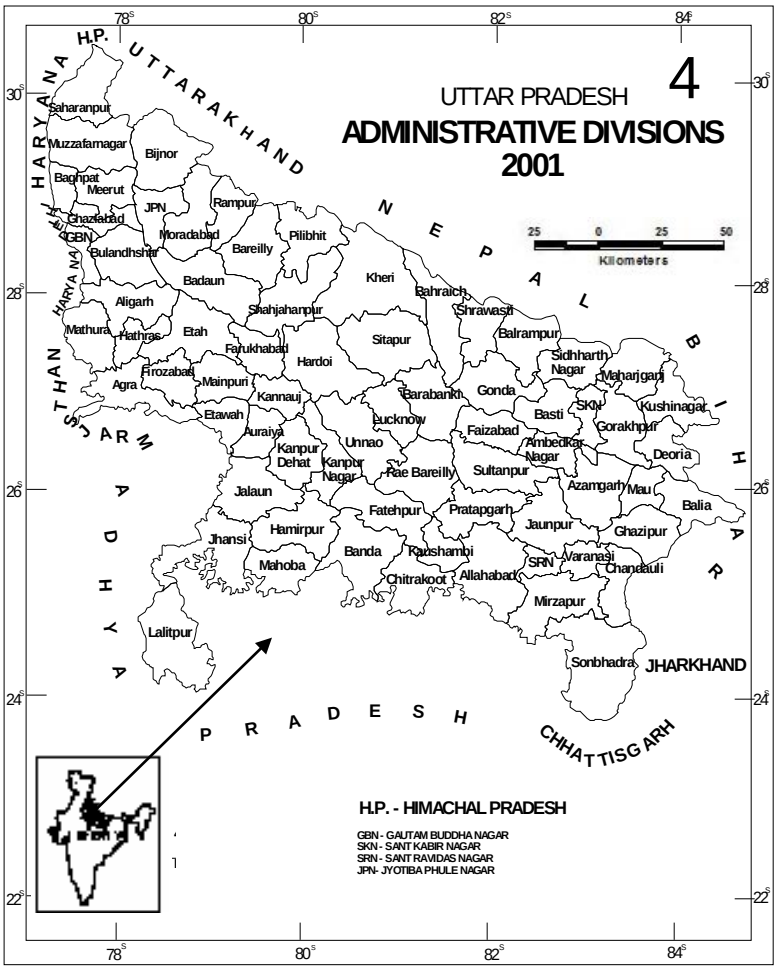

Figure 1

The total population of Uttar Pradesh is 166.20 million (Census 2001) constituting 16.16 per cent of the country's population of which 79.22 pr cent is rural and 20.78 per cent urban. Population density is 690 persons per sq. km. (2001). This is much more than the average density of population in India (325 persons per sq. km). The western and the eastern regions are the most populous, together comprising 76.9 per cent of UP's population. Of these regions, the western region is relatively developed with a per capita income double that of the poorest eastern region. Industries are located mainly in the western and central regions. The highly productive western region is part of the granary of India, although some of the backward regions such as eastern UP are slowly catching up. Land resources are most abundant (in per capita terms) in the Bundelkhand

region, followed by the western region, but the former region has the lowest irrigation intensity.

The State can be divided into two physiographic zones namely, the Southern hill plateau and the vast alluvial Gangetic plains. The entire State is mainly drained by the rivers; Ganga, Yamuna, Ramganga, Gomti and Ghaghra which play significant role in agricultural operations. Climate of the State is hot and humid with temperatures ranging from 5 ^{0}C during winter to 45 ^{0}C in summer. Annual rainfall ranges from 1,000 mm to 1,200 mm.

Uttar Pradesh economy is dominated by agriculture, which employs about two-thirds of the work force and contributes about one-third of the State income. The average size of holding is only 0.86 hectare, and that 75.4 per cent of holdings are below one hectare. Uttar Pradesh is a major food grain producing state and its specialization is in rice, wheat, chickpea and pigeon pea. Sugarcane is the principal commercial crop of the state, largely concentrated in the western and central belts. UP is also a major producer of vegetables, fruits and potato.

b) Spatial Patterns of Level of Agricultural Development

In the present study agricultural development has been considered to be the function of 14 indicators which have been grouped into five categories. The composite index of agricultural development based on the aggregation of these five categories as given in table-1.

Table 1 : Levels of Agricultural Development in Uttar Pradesh, 2001

Category	Composite Score Range	No. of Districts	Percentage of the Total District
Very high	0.45 and Above	9	12.86
High	0.15 to 0.45	11	15.71
Medium	-0.15 to 0.15	27	38.57
Low	-0.15 to -0.45	16	22.86
Very Low	Below -0.45	7	10.00
		70	100.00

Fig.2 shows the spatial distribution of region of different level of development. The districts under the very high category (above 0.45 score) constitute two distinct regions in the north-western part of the state. The former region relatively large size includes the districts of Bulandshahr, Rampur, Pilibhit, Shahjahanpur, Moradabad, Kheri and Budaun and the later comprises Saharanpur and Muzaffarnagar districts (Fig.2). Eleven districts of the state fall under the high level of development (0.15 to 0.45 score) and form a notable region around the periphery of very high level of development in the western and central parts of the state. However, all these districts have the highest value in the case of majority of the selected indicators. The region of moderate level of agricultural development (-0.15 to 0.15) covering about 39 per cent districts of the state and they form a big patch extending from western district down to the southern upland.

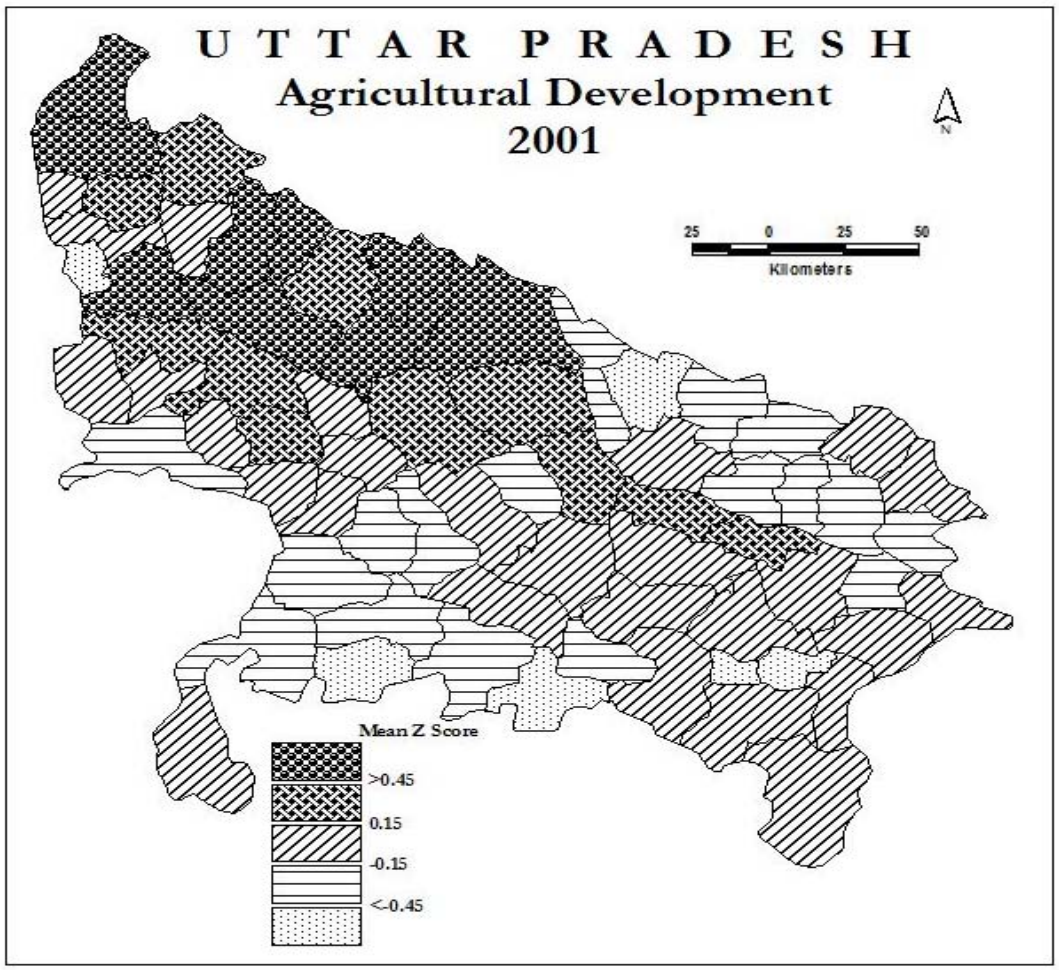

Figure 2

The other region of relatively small in size observed is western part. In many of these districts the selected indicators have high value. About 23 per cent districts of the state share low level of agricultural development (-0.45 to -0.15 score) and form two identifiable regions. One relatively large size occurs in the south-western part and the second comprised of eight districts lies in the north-eastern part. The districts of very low grade (below -0.45 score) of agricultural development are scattered sporadically forming a definable region in the state. Here, almost all the chosen indicators are at the low web.

The general picture which emerges from the spatial distribution that overwhelming majority of the north-eastern and southern districts is shown backward in the light of selected variables. The western and central plain districts give an impression of being in a higher side of the scale of development.

c) Spatial Patterns of Level of Regional Disparities

In order to assess the overall level of regional disparities, districtwise z score of 26 indicators having varying nature and characters is calculated separately. A composite index of each districts have been worked out on the basis of these indicators. The interdistricts variations in composite value of z score ranges from -0.96 in Sharawasti to 0.79 in Lucknow districts among the districts of Uttar Pradesh. The districts may be conveniently arranged into five categories of z scores of very high (0.30 and over), high (0.10 to 0.30), medium (-0.10 to 0.10), low (-0.30 to -0.10) and very low (-0.30 and below) z scores fo levels of regional disparities (Table-2).

Table 2 : Levels of Regional Disparities in Uttar Pradesh, 2001

Category	Composite Score Range	No. of Districts	Percentage of the Total District
Very high	> 0.30	8	11.43
High	0.10 to 0.30	14	20.00
Medium	-0.10 to 0.10	27	38.57
Low	-0.30 to -0.10	12	17.14
Very Low	< -0.30	9	12.86
		70	100.00

The distribution pattern of level of regional development is uneven all over the districts and presents a very complex picture (Fig.3). Considering these grades separately, we find that the districts having very high level of regional development constitute three distinct regions, two regions in the western part and the third in the extreme eastern part of the state. All these districts have highest value in case of selected indicators. The high level of regional development districts constitutes two small but distinct regions. One which is large in size lies in the southern part and comprises three districts; Jhansi, Jalaun and Hamirpur. Second which is relatively small in size is found in the eastern part and includes two districts; Azamgarh and Ghazipur which is bit surprising. The other districts of the same grade are scattered in the state. These districts, by and large, rank high in case of selected indicators. The region of moderate level of development covering the largest number of districts (23) and constitute three prominent regions in the state. One lies in the north-western parts that runs from Sitapur in the north to Aligarh in the west and form a longitudinal belt in the state. The second region occurs in south-eastern part and the third in the extreme western part comprising the districts of Muzaffarnagar, Bijnor and Baghpat districts. About 20 per cent districts fall under the grade of low level of regional development. These districts form a number of small regions of which the most prominent one occurs in the north-western part comprising Bareilly, Pilibhit, Kheri and

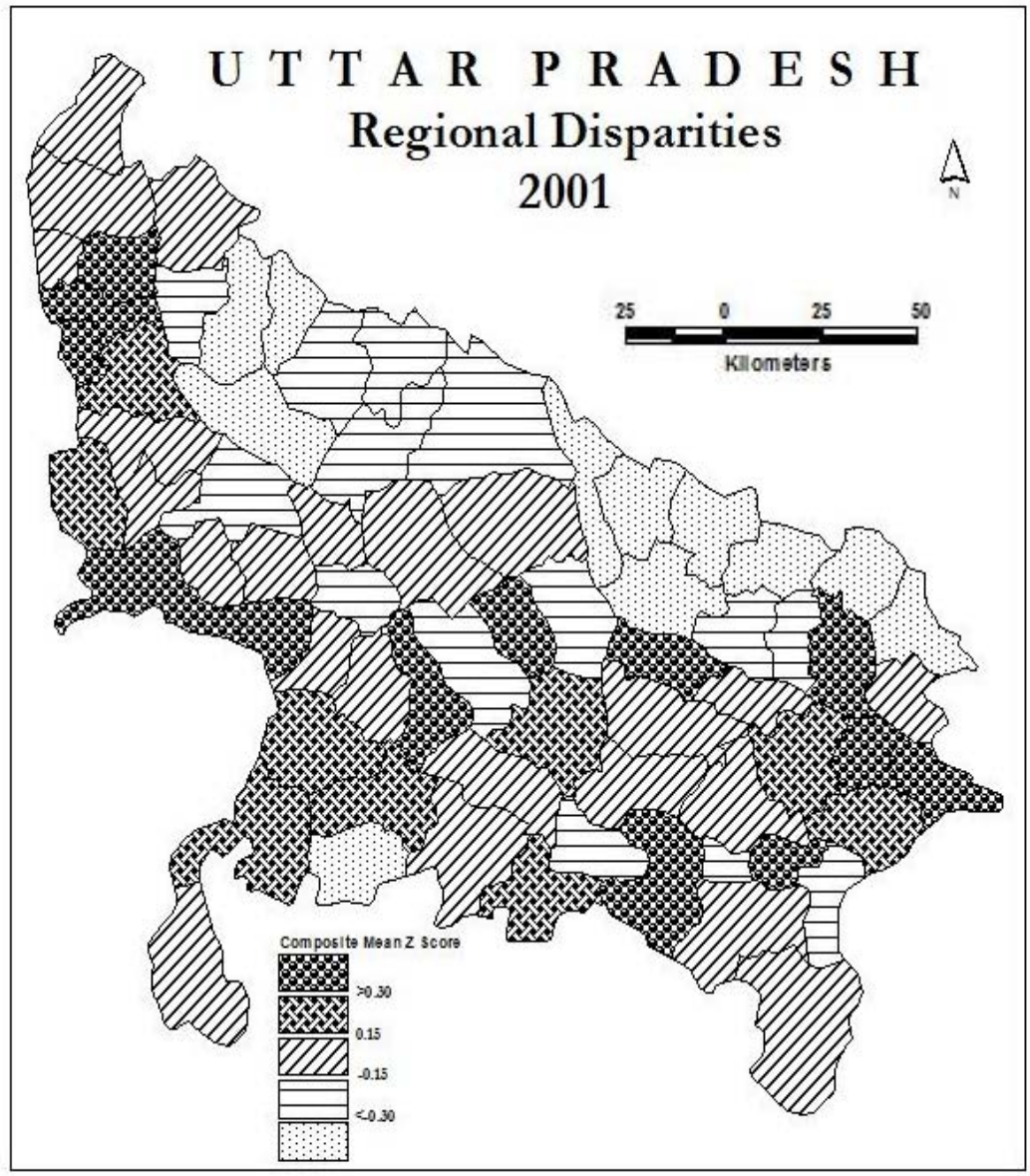

Figure 3

Shahjahanpur districts. The other districts of this grade are scattered over the state. These districts rank low in case of selected indicators. About 16 per cent districts fall under the very low level of development and form two notable regions. One occurs in the north-eastern part and second lies in the north-western part comprising three districts. All these districts stand very low in case of almost all the selected indicators.

The general picture that emerges from this discussion is that the Tarai districts show backwardness in the light of all variables. The western, central and southern districts give an impression of being in a more favourable position.

d) Agricultural Development vis–a-vis Regional Disparities

The regional dimensions of agricultural development vis-à-vis regional disparities are shown in Fig.4. In the key of the map, abscissa represent agricultural development and ordinate the levels of regional disparities. The categories in terms of values are found to be the same for the agricultural development. The districts with reference to composite 'z' score may be arranged into three categories- high (0.15 and over), medium (-0.15 to 0.15 scores) and low (below – 0.15 scores).

The figure reveals that about one-third districts of the state lie under the low grade of agricultural development, of which 8 districts are associated with low, two medium and 13 districts high score of the regional disparities. A prominent region of low agricultural development vis-à-vis low level of regional development is found in the north-eastern part of the state. Thirteen districts belong to low level of agricultural development versus high level of development, majority of them form a dominant region in the south-central part. The other districts of this grade are so scattered that they fail to form a definable region in the state. Only two districts i.e., Banda and Deoria have low level of agricultural development with medium level of regional development.

There are 27 districts of the state which come under the medium category of having medium level of agricultural development in which 8 districts show high level, 12 medium levels and 7 low level of regional development. These districts are observed in the eastern and south-central part of the state. A small region of high development coincides with medium level of agricultural development is found in the eastern part to include the districts of Azamgarh, Balli and Ghazipur. The other districts of the same grade are so scattered that they do not form any identifiable region. Two small but distinct regions of medium level of agricultural development versus medium level of regional development constitute in the eastern part of the state. The districts of the medium level of agricultural development versus low level of regional development are scattered sporadically forming a distinct region in the state.

In the high grade of agricultural development (+0.15 z score and over) there are 20 districts, of which three districts- Meerut, Bulandshahr and Fiazabad have high level of development., eight medium level and nine low level of regional development. A dominant region of high level of agricultural development versus low level of regional development is identified in the north-western part of the state. The districts of high grade of agricultural development versus medium level of development are making two separate regions in the study area. One region is located in the western part and another in the central part of the state.

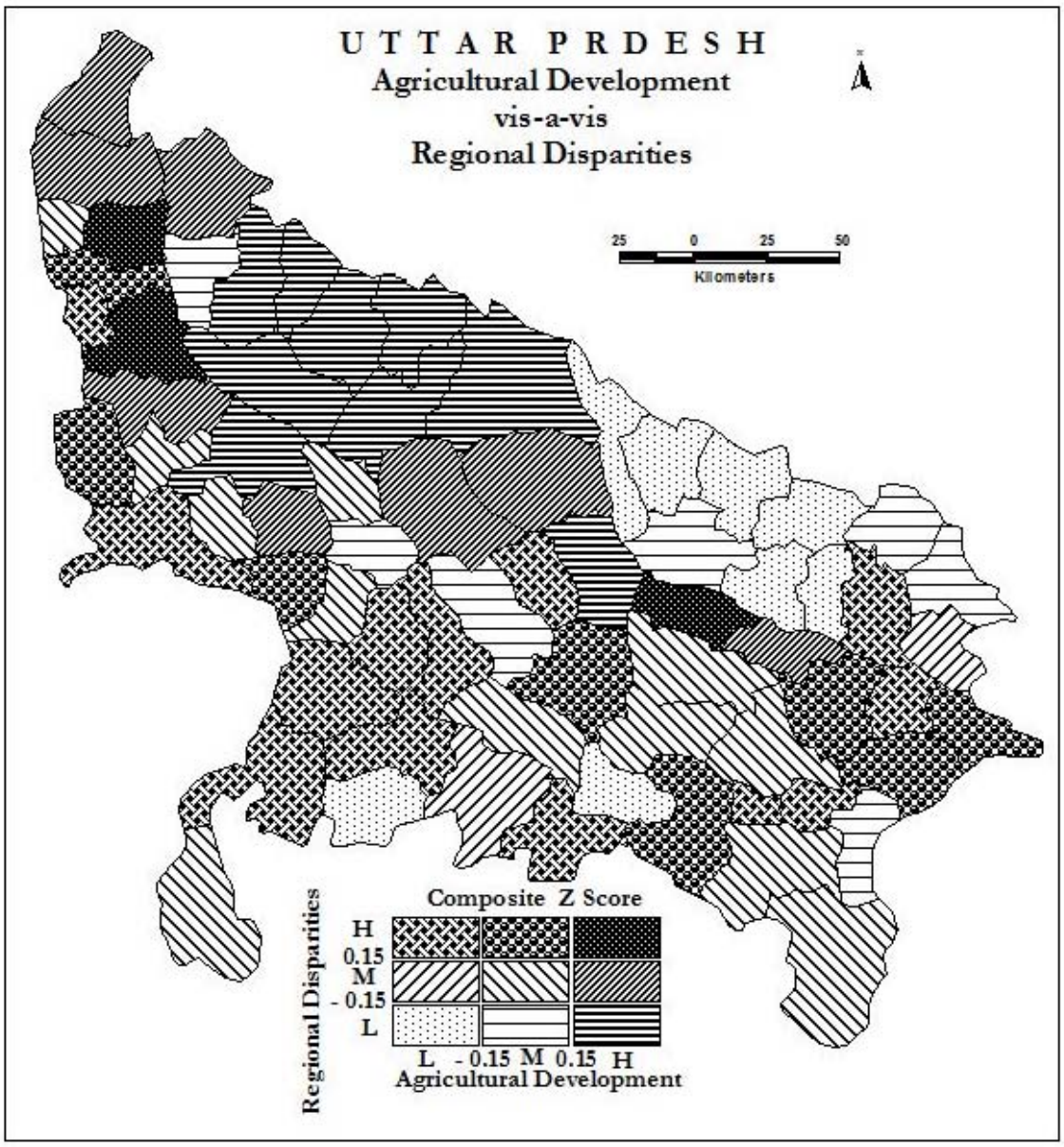

Figure 4

e) Relationship Between Agricultural Development and other Selected Variables

In order to investigate, relationships have been sought between agricultural development and other twenty six variables of the seventy districts of Uttar Pradesh. Selection of each variable is based on an ability to develop a rational hypothesis of relationship between the variable and agricultural development. A complete list of variables that affect or may probably affect agricultural development of the district is given in table-4.

Table 4 : Results of Correlation between Agricultural Development and other Selected Variables of Regional Disparities in Uttar Pradesh, 2001

Variables	Definitions	Agricultural Development (Y_1)
X_1	Literacy rate	-0.227
X_2	Male literacy rate	-0.285*
X_3	Female literacy rate	-0.163
X_4	Population growth (1991-2001)	-0.011
X_5	Percentage of urban population	-0.007
X_6	Sex ratio	-0.151
X_7	Population density	-0.117
X_8	Schedule Caste population to total population	-0.141
X_9	No. of JBS & Senior Basic Schools/lakh population	-0.142
X_{10}	No. of HSS & Degree Colleges / lakh population	-0.119
X_{11}	Educational institute/ Student ratio	-0.016
X_{12}	Teacher / Student ratio	0.029
X_{13}	No. of Medical (Allopathic) institution per lakh population	-0.237*
X_{14}	No. of Beds in Hospitals/ Dispensaries (Allopathic) per lakh population	-0.184
X_{15}	No. of Hospital/Dispensaries (Homeopathic) Medical Services (Govt.) per lakh population	-0.242*
X_{16}	No. of Doctors per lakh population	-0.224
X_{17}	No. of Family welfare clinic / Centres per lakh population	-0.172
X_{18}	Percentage of workers engaged in the non-agricultural activities	-0.096
X_{19}	No. of livestock population per lakh population	0.204
X_{20}	No. of persons engaged in registered factories / Lakh population	0.047
X_{21}	Per capita income (at Current Price)	0.050
X_{22}	Percentage of electrified villages to inhabitant villages	0.178
X_{23}	Percentage of villages with linked road	0.293*
X_{24}	No. of post office/ Lakh population	-0.067
X_{25}	No. of telegraph offices / Telephone exchange/ lakh Population	-0.076
X_{26}	No. of regulated markets.	0.395**

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

In order to correlate the agricultural development with 26 independent variables, Pearsonian product moment correlation coefficient (r) has been calculated. The results of correlation coefficient between agricultural development and the variables of levels of regional disparities as shown in Table-4 depict that among the twenty six variables, only one variable (X_{26}) is positively significant at 99 per cent level of confidence with the agricultural development (Y_1). However, (X_{19}) No. of livestock population per lakh population and (X_{22}) percentage of electrified villages to inhabitant villages have low degree of positive relationship with agricultural development. Table also shows that four variables are significant at 95 per cent level of confidence in their relationship with agricultural development (Y_1). They are:

X_2 (Male literacy rate, -0.285),
X_{13} (No. of Medical (Allopathic) institution per lakh population, -0.273),
X_{15} (No. of Hospital/Dispensaries (Homeopathic) Medical Services (Govt.) per lakh population, -0.242) and
X_{23} (Percentage of villages with linked road, 0.293)

Only one variable X_{23} has direct relationship, whereas the remaining three bears inverse relationship with Y_1. Among the variables, the coefficient of correlation of eleven variables (X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{17} and X_{24}) records low degree of negative relationships with agricultural development (Y_1). This explanation leads to conclusion that literacy rate, urbanization, health facilities, educational facilities and infrastructural facilities are the chief determinants but the magnitudes of their effects are dissimilar.

IV. Conclusion

The general picture which emerges from the spatial distribution of agricultural development shows that overwhelming majority of the north-eastern and southern districts is shown backward in the light of selected variables. The western and central plain districts give an impression of being in a higher side of

the scale of development. The above analysis of level of regional disparities clearly indicates that the Tarai districts shows backwardness in the light of all variables. The western, central and southern districts give an impression of being in a more favourable position.

The relationship between levels of agricultural development and levels of regional disparities are marked by substantial increase from west to central and eastern region. Uttar Pradesh is a state where there is a tremendous scope for development in the agricultural sector. Sufficient land is available in the state which could be brought under cultivation and by increasing irrigation facilities, gross crop area can be increased considerably. The districts having low level of regional development should be given top priority so that they may come up at par with developed areas, and the concept of planning with social justice may be fulfilled.

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Run-off Farming in Reducing Rural Poverty in the Cholistan Desert

By Farooq Ahmad
University of the Punjab, New Campus, Lahore, Pakistan

Abstract - This study provides an overview of the potential impact of employing indigenous rainwater- harvesting technology in alleviating poverty in the Cholistan Desert of Pakistan. Ideal characteristics for run-off farming catchments result from the combination of landforms and soil properties. Many soils in the region exhibit low to very low infiltration and high levels of run-off. It has been demonstrated that there is a direct relationship between water availability and poverty reduction. This study outlines both the advantages and disadvantages of the indigenous rainwater-harvesting technology in reducing rural poverty and recommends its use with modern water harvesting techniques.

Keywords : *Catchment, Cholistan, environment, Hakra River, precipitation, runoff.*

GJHSS-B Classification : *FOR Code : 070107*

Strictly as per the compliance and regulations of:

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I. Introduction

The Cholistan Desert is an extension of the Great Indian Desert (Figure 1), which includes the Thar Desert in Sindh province of Pakistan and the Rajasthan Desert in India, covering an area of 2,580,000 ha. It lies within southeast quadrant of the Punjab province between 27°42' and 29°45' north latitude and 69°52' and 73°05' east longitude (FAO/ADB, 1993; Arshad et al., 1995; Jowkar et al., 1996; Ahmad, 1998; Ahmad, 1999a; Ahmad et al., 2004; Ahmad, 2005; Ahmad et al., 2005; Ahmad, 2007a; 2007b; Ahmad and Farooq, 2007; Ahmad, 2008; 2012a; 2012b).

The term *run-off collection* is used to describe the process of collecting and storing water for later beneficial use from an area that has been modified or treated to increase precipitation run-off. *Run-off farming* is the integration of all aspects of collection, storage and utilization of the run-off water (Frasier, 1994; Ahmad, 2008).

In ancient history, the first run-off collecting facility was in all likelihood nothing more than a depression in a rock surface that trapped rainwater. The collected water served as a drinking water supply for man and animals (Hardan, 1975; Ahmad, 2008).

These water depression storages are still found in many parts of the world and serve as a drinking water supply (Shanan and Tadmor, 1979; Ahmad, 2008). It is probable that the first constructed water-harvesting facility was simply an excavated pit or other water storage container placed at the out fall of a rocky ledge to catch run-off water during a rainstorm (Frasier, 1994; Ahmad, 2008). The next evolutionary step may have been the construction of a rock diversion wall or gutter to provide a larger collection area. Researchers have found signs of early water-harvesting structures believed to have been constructed over 9000 years ago in the Edom Mountains in southern Jordan (Bruins et al., 1986; Ahmad, 2008). There is evidence in Iraq that simple forms of water-harvesting were practised in the Ur area in 4500 BC. Along desert roads, from the Arabian Gulf to Mecca, there still exist water-harvesting systems that were constructed to supply water for trade caravans (Hardan, 1975; Ahmad, 2008).

One of the earliest documented complete run-off farming installations is located in the Negev Desert of Israel. These installations were built about 4000 years ago (Evenari et al., 1961; Ahmad, 2008). The run-off area for these systems was upland hillsides, which were cleared of vegetation, and the soil smoothed to increase precipitation run-off. Contour ditches conveyed collected water for irrigating lower-lying fields. These systems provided an irrigated agriculture to an area that today has an average annual precipitation of approximately 100 mm. There is evidence that similar systems were used 500 years ago by the Native Americans in the southwestern region of the USA (Woodbury, 1963; Ahmad, 2008). Evidence of other ancient water-harvesting systems has been uncovered in Northern Africa. There is an uncertainty as to why most of these systems were abandoned. It is possible that the reticulation systems became clogged with silt or that the soils in the crop growing areas became infertile due to increased salinity. Others have speculated that some form of political instability or maybe a climate change in the areas forced the abandonment of the systems (Shanan and Tadmor, 1979; Kohei, 1989; Ahmad, 2008).

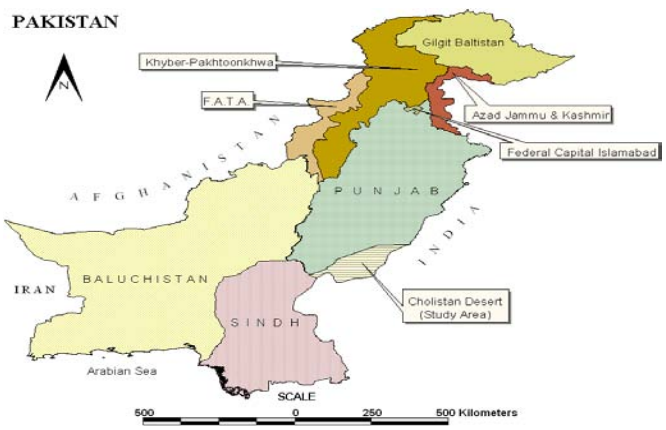


Figure 1 : Location map of Cholistan Desert

Author : Department of Geography, University of the Punjab, New Campus, Lahore, Pakistan. E-mail : drylandpk@yahoo.com

II. Research Design and Methods

The work involves investigation on both constructional and depositional aspects of the archaeological record and the micro-environmental conditions (Ahmad, 2011). It is often possible to relate a soil type to a particular ecological niche in the landscape (Retallack, 1994; Buol et al., 2003; Ahmad, 2011). Soils and their properties is the product of different soil-forming factors (Jenny, 1941; Ahmad, 2011) and the parent material. As soil-forming factors also govern geomorphic processes, landscape evolution is intimately related to soil development (McFadden and Kneupfer, 1990; Kapur and Stoops, 2008; Ahmad, 2011; Kapur et al., 2011).

Traditional purposes for water resources control, storage and delivery include soil erosion prevention, rainwater harvesting, irrigation and supply of drinking water. Some of the structures associated with this have survived for many centuries. This indicates that advanced procedures had been used in their design and construction. However, it appears that indigenous knowledge has neither been well documented nor scientifically analyzed in order to utilize it for supporting the sustainable development of rain-fed run-off and spate-irrigated farming (Ahmad, 1999c).

The purpose of this study was to review and consider the potential for using water harvesting of run-off for agricultural and domestic uses to alleviate poverty in the Cholistan Desert region of Pakistan.

a) Climate of the Study Area

The climate of the area is an arid sub-tropical, continental type, characterized by low and sporadic rainfall, high temperatures, low relative humidity, high rates of evaporation and strong summer winds (Khan, 1957; Ahmad, 2008). The study site is one of the driest and hottest areas in Pakistan. The mean annual temperature of the area is 27.5°C; the mean summer temperature is 35.5°C, and the mean winter temperature is 18°C. The mean maximum summer temperature is 46°C (Figure 2) and the mean minimum winter temperature is 7°C. The month of June is the hottest and daily maximum temperature normally exceeds 45°C and occasionally is above 50°C (Ahmad, 2002a; Ahmad, 2008). The daily maximum temperature decreases in July due to the monsoon rainy season. There is always an abrupt fall in temperature during the nights. Most of the rainfall in the area is received in the months of July, August and September during the monsoon season. The annual rainfall varies between 100 and 250 mm. About half of the total rainfall events do not result in run-off, although they usually result in a favourable environment for the growth of vegetation (Abdullah et al., 1990; Ahmad, 2008).

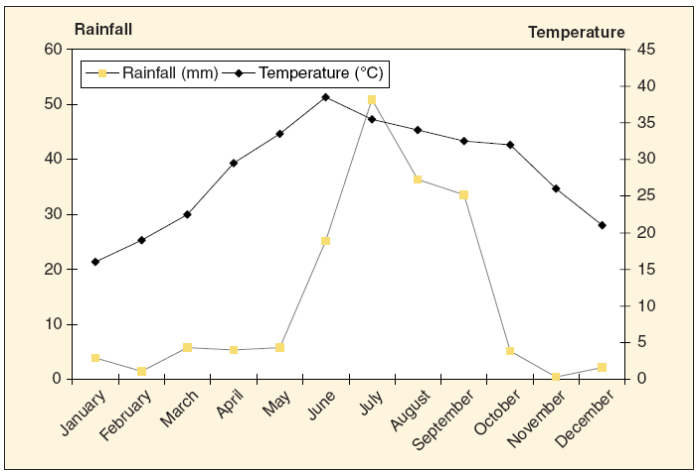
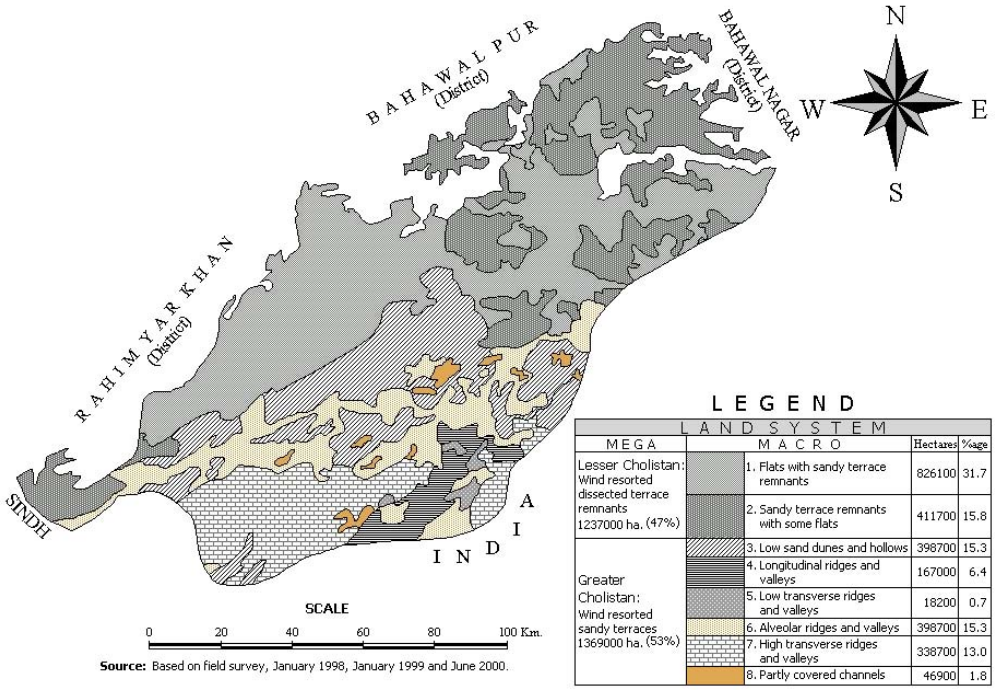


Figure 2 : Ombrothermal diagram of Cholistan Desert
Source: After Akhter, R. and Arshad, M. (2006).

b) Geomorphology

Geomorphologically the area presents a relatively complex pattern of alluvial and aeolian deposition which has developed from: (a) wind re-sorting of the sediments into various forms of sand ridges, (b) re-sorting and further deposition in spill channels, (c) deposition of sediments into clayey flats and (d) wind re-sorting and dune formation (FAO/ADB, 1993; Ahmad, 2008). The soils of the area have been developed by two types of materials, *viz.* river alluvium and aeolian sands (Ahmad, 2002a; Ahmad, 2008). The alluvium consists of mixed calcareous material, which was derived from the igneous and metamorphic rocks of the Himalayas and was deposited by the Sutlej and abandoned Hakra Rivers most probably during different stages in the sub-recent periods. The aeolian sands have been derived mainly from the Rann of Kutch and the sea coast and also from the lower Indus Basin. Weathered debris of the Aravalli has also contributed. The material was carried from these sources by the strong south-western coastal winds (FAO/ADB, 1993; Ahmad, 2008).

Based on differences in landform, parent material, soils and vegetation, the Cholistan Desert can be divided into two main geomorphic regions: the Northern region, known as the Lesser Cholistan, which constitutes the desert margin and consists of a series of saline alluvial flats alternating with low sand ridges/ dunes; and the Southern region, known as the Greater Cholistan, a wind re-sorted sandy desert, which is comprised of a number of old Hakra River terraces with various forms of sand ridges and inter-ridge valleys (Baig et al., 1975; Tahir et al., 1995; Ahmad, 2008). The Mega Land Systems (Lesser and Greater Cholistan) are split into eight Macro Land Systems (Figure 3), based on geomorphology which controls soils, moisture and eventually vegetation – an important component of the range ecosystems on which pastoralism depends (Figure 4, 5).



LEGEND

LAND SYSTEM				
MEGA	MACRO		Hectares	%age
Lesser Cholistan: Wind resorted dissected terrace remnants 1237000 ha. (47%)		1. Flats with sandy terrace remnants	826100	31.7
		2. Sandy terrace remnants with some flats	411700	15.8
Greater Cholistan: Wind resorted sandy terraces 1369000 ha. (53%)		3. Low sand dunes and hollows	398700	15.3
		4. Longitudinal ridges and valleys	167000	6.4
		5. Low transverse ridges and valleys	18200	0.7
		6. Alveolar ridges and valleys	398700	15.3
		7. High transverse ridges and valleys	338700	13.0
		8. Partly covered channels	46900	1.8

Processed by the author

Figure 3 : Land system of Cholistan Desert

Figure 4 : Habitation condition on sandy desert at Cholistan Desert. Ahmad, Farooq 2008

Figure 5 : Lizard looking for food at Cholistan Desert. Ahmad, Farooq 2008

c) Soils

The sand dunes have undulating to steep topography, with the dunes lying parallel to each other and connected by small streamers. They are very well drained and have coarse textured, structure-less soils derived from aeolian material. The near level to gently sloping areas have deep to very deep sandy soils which are very well drained, calcareous and coarse textured (Baig et al., 1975; Ahmad, 2008). Loamy soils occur on the level to near level areas with hummocks of fine sand on the surface. These soils are moderately deep, relatively well drained, calcareous and with a moderately coarse to medium texture (Baig et al., 1975; FAO/ADB, 1993; Ahmad, 2008). Clayey soils occur on level areas and are moderately deep, poorly drained, calcareous, saline-sodic (Table 1), moderately fine textured to fine textured with a pH range from 8.6 to 10.0 (Baig et al., 1980; Ahmad, 2008).

Table 1 : Types of soil and wind erosion

Soil Types	Total Area (ha)	Total Area (%)	Wind Erosion (degree)	Wind Erosion Area (ha)	Wind Erosion Area (%)
Loamy soils	58,700	2	Moderate	58,700	2
Saline sodic clayey soils (*Dhars*)	441,900	17	Non or slight	441,900	17
Sandy soils	945,500	37	Severe	2,079,400	81
Sand dunes	1,133,900	44			
Total	2,580,000	100	Total	2,580,000	100

Source : After Pakistan Desertification Monitoring Unit (1986).

d) Water resources of Cholistan Desert

The primary source of water is rainfall and this is the only source of potable ("sweet") water in Cholistan. Rainwater is collected in natural depression or man-made ponds called locally *"tobas"* (Figure 6, 7). There are 598 *tobas* in Cholistan (CDA, 1996; Ahmad, 2008) where desert dwellers collect and store rainwater from natural catchments. *Dhars* provide an efficient catchment for rainwater-harvesting. Water loss through evaporation from these ponded water storages was estimated to be higher than for seepage losses (Khan et al., 1990; Ahmad, 2002a; Ahmad, 2008). The average rainfall in Cholistan is 100-250 mm. Most of the rainfall is received during the monsoon season from July to September however; some of it may fall during winter. If harvested and stored appropriately, a large quantity of water would be available for humans and livestock as well as for plant nurseries and growing forage (Baig et al., 1980; Ahmad, 2008).

The secondary source of water in the Cholistan is groundwater, which is saline and not suitable for drinking or agricultural purposes. However, in this region, even brackish water is being used for livestock and other domestic purposes. The aquifers in the Cholistan are deep as a result of the absence of stream flow and only neglible recharge from rainwater. Changes in water quality of wells relates to the type and amount of salts present in the parent material. Most of the groundwater resources are alkaline in reaction causing precipitation of Ca^{2+}, SO_4^{2-} and CO_3^{2-} ions and increasing the ionic balance of Na^+ and Cl^- in the water (Abdullah et al., 1990; Ahmad, 2008). The groundwater, located at depths ranging from 30 to 90 metres, has salinity levels ranging from 368 to 35,000 mg/l of total dissolved solids (Baig et al., 1980; Ahmad, 2008).

Two major aquifers in the Cholistan have "sweet" water but these are surrounded by saline water. The main aquifer extends for 80 km from Fort Abbas towards Moujgarh, and is 10-15 km wide. The aquifer lies between 40 to 100 metres below the surface and has an estimated volume of 10 gigalitres (FAO/ADB, 1993; Ahmad, 2008).

The second aquifer has its centre approximately 20 km north-west of Derawer Fort. It occupies an area of 50 km^2, has a maximal thickness of 100 metres, and lies about 25 metres below the surface. This "sweet" aquifer is surrounded and underlain by bodies of brackish to saline waters (FAO/ADB, 1993; Ahmad, 2008). "Sweet" water in Cholistan is also present as isolated lenses at Phulra, Moujgarh, Dingarh and Derawer Fort along the abandoned Hakra River bed and Bhai Khan, Ghunnianwala, Islamgarh, Lakhewala and Renhal near the Pakistan-India border. Salinities of less than 1,900 mg/l TDS at the last three locations indicate they are more than suitable for human drinking. Livestock can tolerate levels as high as 15,000 mg/l TDS, or more in the case of camels (Baig et al., 1975; Baig et al., 1980; Ahmad, 2008).

Figure 6 : Adaptive approach for local *toba* at Cholistan Desert. Ahmad, Farooq 2008

Figure 7 : Indigenous approach for local *toba* at Cholistan Desert. Ahmad, Farooq 2008

Because of low and spatially erratic rainfall, water scarcity in Cholistan is endemic. Low rainfall, high infiltration in the sandy soils and rapid evaporation preclude the establishment of permanent sources of surface water in the desert. However, shallow ephemeral lakes are formed in *dhars,* which have highly impervious loam or clay soil bases, often of a saline or saline-sodic nature (Abdullah et al., 1990; Ahmad, 2008). The *dhars* are surrounded by sand dunes so that they form a terminal drainage system.

e) Surface water development for irrigation

Water harvesting/runoff-farming in the Cholistan Desert can play an important role in supplying local people and their livestock with drinking and minor irrigation. It is estimated that if approximately 60% of the average annual rainfall of 120 mm was harvested from 17% of the total catchment area (*i.e.* the saline-sodic component - Table 1) then 318 Ml of water could be stored and used for drinking and growing vegetables per year. This volume would cover approximately 106000 ha to a depth of 30 cm. It is observed that at Dingarh, where the soil is clayey, run-off is initiated after 11 mm of rainfall and on sandy soils the run-off starts after receiving approximately 33 mm of continuous rainfall. The Pakistan Council of Research in Water Resources (PCRWR) is collecting run-off at Dingarh in earthen excavations which are 32.11 m sq and 3.67 m deep (volume = 3784 m^3) (PADMU, 1986; Ahmad, 2008).

Water harvesting/runoff-farming techniques are technically sound methods of water supply. There have been many water-harvesting/runoff-farming systems constructed and evaluated at many different locations in the world. Some of the systems have been outstanding successes, while others were complete failures. Some of the systems failed, despite extensive effort, because of material and/or design deficiencies. Other systems failed, in spite of appropriate material and design, because of social and economic factors that were not

adequately integrated into the systems (Frasier, 1983; FAO, 1994; Ahmad, 2008). Other factors contributing to the failures were personnel changes, the water were not needed, lack of maintenance and/or communication failures. A successful system must be (Cluff, 1975; Hutchinson et al., 1981; Pacey and Cullis, 1986; Ahmad, 2008):

- Technically sound, properly designed and maintained
- Socially acceptable to the water user, and
- Economically feasible in both initial cost and maintenance at the user level.

The landforms and soil characteristics of the Cholistan Desert indicate that it is a very suitable area for rainwater harvesting. Some sites, partly because of their very poor drainage, are capable of generating maximum run-off (Shanan and Tadmor, 1979; Ahmad, 2008). Water infiltration is low to very low in the fine textured soils of the Cholistan desert. This may be related to the absence of soil pores or very poor porosity. Figure 8 illustrates the areas in the Cholistan Desert which are considered suitable for rainwater harvesting.

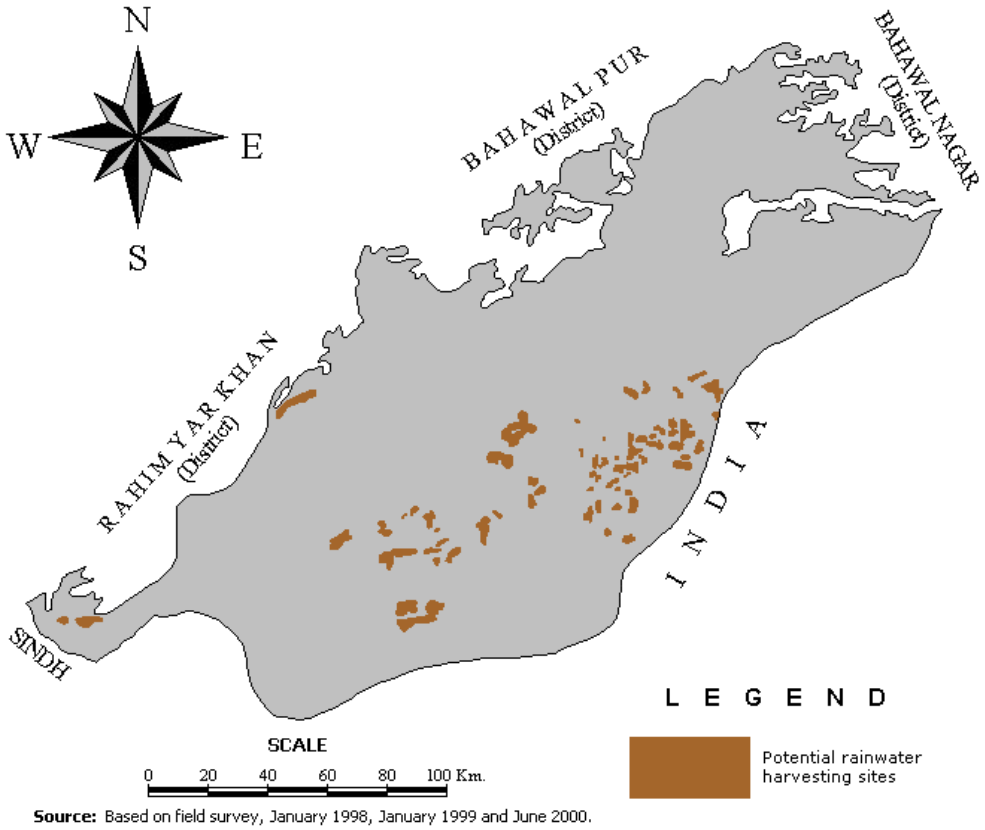


Figure 8 : Potential rainwater harvesting sites in the Cholistan Desert *Processed by the author*

f) Use of ground saline water for irrigation in Cholistan Desert

Although the groundwater is saline, it can be used for irrigation to grow salt tolerant trees, vegetables, crops and fodder grasses in non-saline, non-sodic coarse textured soils (Baig et al., 1975; Ahmad, 2008). This can occur with minimum adverse effects due to the rapid leaching of salts beyond the root zone (Abdullah et al., 1990; Ahmad, 2008).

Flushing of salts from the root zone also occurs after rain. Furthermore, fine textured saline-sodic soils can be used for growing palatable grasses which are very salt tolerant and capable of surviving in soils with otherwise poor agricultural potential. The sandy and loamy textured soils that cover 1 million ha can be brought under agriculture by using underground saline water and harvested rainwater (Ahmad, 1999b; Ahmad, 2008).

Experiments have shown that where sandy gravel or dune sands occur, plants can survive very well under the use of harvested rainwater and vast areas of land could be irrigated. Moderately saline irrigation water stimulates vegetation, assists the benevolent bacteria of the soil and improves yield and quality. Further, use of brackish water reduces soil evaporation, transpiration of plants and increases resistance to drought (Abdullah et al., 1990; Ahmad, 2002b; Ahmad, 2008).

g) Water harvesting and conservation as a strategic tool

Current strategies for combating drought include early warning and drought monitoring,

contingency crop planning for drought-proofing, integrated watershed management, improved agronomic practices, alternative land use systems, management of livestock, animal health, feed and fodder resources and socio-economic aspects (Khan, 1992; Ahmad, 2008). All these components are essential and important and contribute to the alleviation of the impacts of drought. However, it has been noted that the most strategic tool for combating and mitigating droughts is enhanced water supplies at the local level (Sharma, 2003; Ahmad, 2008). This may be achieved partially through importing water from other less affected regions, but more sustainably through water harvesting and conservation in the drought prone region itself. Water harvesting, although an age-old practice is emerging as a new paradigm in water resource development and management due to recent efforts of both government and non-government organizations and several innovative communities (Sharma, 2001; Ahmad, 2008). Several 'bright spots' of successful water harvesting measures for drought-proofing are readily evident in operation in Pakistan, India, Iran, China and several other countries (Michael and Jowkar, 1992; Jowkar and Michael, 1995; Ahmad, 2008). The water resources generated locally help in meeting domestic and livestock needs, provide water for supplementary irrigation, enhance groundwater recharge, reduce storm water discharges, urban flooding and sea water intrusion in coastal areas. Participatory management of water resources ensures effective utilization, maintenance and sustainable operation of these systems (Ahmad, 1997a; Ahmad, 2008).

The Government of Pakistan is committed to international action in dealing with issues of sustainable development and poverty-eradication and is taking the necessary steps, given its resource and capacity constraints, to honour its pledge to contribute to the targets agreed to by the member states of the UN in the Millennium Development Goals (Farooq et al., 2007; Ahmad, 2008). It is the firm resolve of the Government to work with the various stakeholders in the public and private-sector in meeting those commitments (Ahmad, 1997a; Ahmad, 2008).

h) Poverty Issues

The main issues of poverty (GOP and IUCN, 1992; Ahmad, 2008) in areas such as the Cholistan Desert relate to:

- Drinking water scarcity for human and livestock population.
- Fodder shortage for livestock.
- Forced migration of human and livestock toward irrigated lands due to shortage of water and fodder.
- Absence of a proper livestock marketing system.
- Absence of industry relevant to livestock products – milk, wool and hides.
- Lack of medical facilities for humans and livestock.
- Lack of education because of the non-availability of schools and teaching staff.
- Lack of communication facilities.

It has been observed that poverty and lack of water, even for drinking, tend to encourage people to focus on immediate needs rather than on those benefits that may materialize only in the long term (GOP and IUCN, 1992; Kharin et al., 1999; Ahmad, 2008). This is not to say that poor land users are land degraders (Thomas, 1997; Ahmad, 2008), while the rich are conservers. Soil conservation is often viewed by many land users as being a cost and inconvenient (Farooq et al., 2007; Ahmad, 2008).

The traditional knowledge of the local inhabitants enables them to detect soil moisture and water-holding capacity using very simple methods (UNEP, 1991; Ahmad, 2008). They examine the soil subsurface for moisture, and the suitability of the soil agriculture, by rolling up a handful of soil and testing its compactness and stability. This traditional methodology allows the testing for soil moisture before cultivation, a procedure that enhances soil conservation (GOP and IUCN, 1992; Ahmad, 2008). The problems of soil erosion can be addressed, and certain practices can lead to soil enhancement and rebuilding. These options include (Ittelson, 1973; Hanan et al., 1991; Ahmad, 2008):

- Stopping the overuse that leads to the destruction of vegetation.
- Controlling overgrazing of animals (their trampling and grazing diminishes the vegetative cover).
- Enhancing rehabilitation techniques by propagation of native species.
- Careful implementation of agro-diversity (*i.e.* avoiding the planting of a monoculture).
- Shelter-belts (wind breaks) planted perpendicular to the prevailing wind direction (effective in reducing the wind speed at the soil surface).
- Strip farming: This involves planting crops in widely spaced rows but using the inter-row spaces for another crop to ensure complete ground cover (FAO/UNEP, 1983; Megateli et al., 1997; Ahmad, 2008). This retards overland flow of water, enhances infiltration and reduces soil erosion.

i) Constraints

The major constraint for livestock production in Cholistan Desert is the shortage of "sweet" water (Ahmad, 1997b; Ahmad, 2008). This is compounded by the prolonged droughts (often several years) when *toba* water dries out completely (Ahmad, 2002a; Ahmad, 2008).

In the Greater Cholistan, feed for livestock may still be available during a drought, but the *toba* water is depleted and the thirsty herds are forced to migrate towards semi-permanent settlements where well water is adequate but of poor and saline quality, not fit for

drinking (Baig, 1982; Ahmad, 2008). The wells are unlined and must be re-dug each season. However, in the western part (Lesser Cholistan) the quantities of both water and feed are inadequate during drought periods (Khan, 1992; Ahmad, 2008).

Landless pastoralists suffer due to the scarcity of rangelands for grazing in the irrigated fringes (Squires, 1998; IFAD, 1998; Ahmad, 2008) where they work as poorly-paid labour or as tenant farmers on farmlands generally used for agricultural crops (Khan, 1992; Farooq et al., 2007; Ahmad, 2008). The combination of long distances travelled by the livestock in search of forage, very high temperatures (above 50°C), inadequacy of feed, under-nourishment and highly saline drinking water from wells, all contribute to high mortality rates.

III. Conclusions

The potential for water harvesting in different countries and regions is not yet fully understood, quantified and implemented. Indigenous and innovative technologies in the form of micro-catchments, storage cisterns, run-off water harvesting based farming, embankment ponds, check dams on natural streams, percolation tanks, recharge tube wells, sub-surface barriers, integrated watershed development and rainwater-harvesting in urban areas offer a large potential even under water scarce regions.

Several village-level success stories have demonstrated that water harvesting based development paradigms were able to mitigate drought and positively impact on household economies. Limited studies indicate that rainwater-harvesting measures, when adopted on a large scale, may minimize the risk of water scarcity even during severe drought years. Further research is needed to ascertain more accurately to what extent these interventions would assist communities to withstand droughts.

Water harvesting as a strategic tool for drought mitigation can be realized through a policy framework to develop institutional mechanisms for water harvesting at different levels such as user, watershed, urban locality, district, state and federal level by having representatives from local level people's institutions, non-government organizations and concerned government departments. It is recommended that small and micro-water harvesting systems should be made an integral part of catchment wide planning and water resource development at the regional and national levels.

Biographical Sketch

Farooq Ahmad is an Assistant Professor at the Department of Geography, University of the Punjab, Lahore, Pakistan. He holds a Ph.D. in Geography (2002) and Post Doctoral Fellow (2009), the Department of Geography, The University of Sheffield, United Kingdom. His expertise is archaeo-historical environmental surveys and multi-disciplinary studies on ancient settlements in the Cholistan desert. He has contributed more than 50 research papers to international conferences around the globe. His current research involves Rainwater harvesting, Geomorphology, Geoinformatics, Remote Sensing, Satellite Image Processing, Hyperspectral Image Analysis, GPS and Land Surveying.

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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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