

A Review of Potential Adaptation Strategies for Climate-Smart Sustainable Agricultural Development

Abdul Khaliq¹, Dr. Ghulam Murtaza²,

Dr. Mohammad Ashraf³ & Dr. Mir Sadaat Balch⁴

Abstract

Climate change is a real phenomenon and it has affected many sectors. The very sector that has been badly affected by the climate change is agriculture. In addition to other factors it is widely understood that few unsustainable agriculture practices are also responsible for climate change which affected agriculture itself. Climate change has also affected the rainfall thereby reducing the agriculture productivity to feed the rising population of the world. Addressing of these issues requires sustainable use of resources through integrated practices in Agriculture. The concept of sustainable agriculture has gained prominence since Brundtland Report in 1987, but it is still obscure in its meaning. For bringing such desirable changes it is mandatory to assess the behavior of the farmers in connection with the principles and concepts of sustainable agriculture. Moreover, enhancing and fortifying human capital, through instruction, effort, and extension administrations, enhances basic leadership limit at each level and builds the aggregate ability to adjust climate change impacts.

Key words. Climate Change, Sustainable Agriculture, Coping Strategies, Adaptation, Vulnerability.

1. Introduction: Decision Making Under Uncertainty.

Climate change is a real and imperative question. The global environment is changing, and the human exercises have added to it altogether. However, the

¹ M.Phil Scholar, Disaster Management and Development Studies University of Balochistan, Quetta

² Assistant Professor, Disaster Management and Development Studies University of Balochistan, Quetta

³ Assistant Professor, Disaster Management and Development Studies University of Balochistan, Quetta

⁴ Assistant Professor, University of Balochistan, Quetta.

change is much more quick and dangerous than thought before. The universal temperature of the earth has risen by an average of 0.7° C in the 20th century, and proceeds on rising pattern (IPCC 2007).

Sustainability is an idea that is generally straightforward but difficult to practice. At simplest level, it implies great ecological administration and cultivating networks that are productive and prosperous, or put another way, that are feasible and imperative. Sustainability has regularly been considered as far as land degradation issues, after some time supportable farming has needed to address a scope of different issues which are synthetic inputs such as fertilizers and farming chemicals, and now environment change.

Climate change shows another kind of test for development. It is at this point broadly recognized that climate change impacts enhance existing threatening conditions for developing nations (McCarthy et al. 2001). It is likewise recognized that poor people are more incapable and have less limited ability to confront such changes (Swart et al. 2003). Nations with an absence of assets, poor foundation, and insecure establishments have little ability to adjust and are very vulnerable (Smit and Pilifosova 2001).

Climate change is conceivably the greatest test confronting mankind in this century, less in light of the fact that worldwide responsibility, vitality security, nourishment deficiencies, and natural degradation are less vital, but since climate change is inseparably connected with these marvels and can possibly fuel existing emergencies (Morecroft, 2010).

Nonetheless, before examining Agriculture in correlation to the issues of environment change, it is necessary to comprehend the basic job of the agricultural division for edibles. Agriculture is a difficult financial division with complicated impacts affecting on mankind as well as much more on the common surroundings. This is to a great extent because of the way that its production procedure depends on the use of organic and common mixed variety (Walls, 2006:3). (Youdeowei 1986:2) emphasize that nutrition production is vital in the economies of a large portion of the slightest created nations and that Agriculture offer the methods for expanding nourishment and fiber generation. . As indicated by (Hughton, D. 2002) Climate change is potentially the most challenging which the world is facing. However, its impact varies from region to region. The difficulties of climate change are winding up additionally unbearable to practical financial improvement and the totality of human presence (Adejuwon, S.A, 2004).

Agriculture is one of the basic actions for maintaining life on globe. Adams, Chang, McCarl and Collway (2010:1) Agriculture is of evident significance to human welfare and the prosperity of all other living animals. Climate is an important deciding variable for both the areas fit for agricultural business and the profitability of horticultural ventures. Along these lines it isn't astonishing that Agriculture has been recognized as field of worry in the present talk on circumstances and end results of environmental change (Adams et al. 2010:2). All inclusive, the effects of climate change are threat for agricultural practices, particularly for such nations where networks' employments are tried and true from the land. The United Nations Framework Convention on Climate Change (UNFCCC) stressed that temperature transform is connected to advancement and exceptional consideration ought to be given to creating nations that are most defenseless against disasters (UNFCCC 2007). Small scale farmers bear the most in light of their reliance on rain-sustained Agriculture, restricted budgetary limit, low versatile limit, high reliance on normal assets, failure to distinguish the event of extraordinary hydrological and meteorological occasions because of low innovation selection, constrained framework, ignorance, absence of aptitudes, level of mindfulness and absence of ability to expand (Kurukulasuriya et al; 2006a).

One of the issues in such method is that sustainable development is in any event as worrying an issue as climate change, so adding improvement doubts to the climate condition seems to make matters more unpredictable. For instance, there has been a progressing discourse about the absence of achievement of "traditional" Official Development Assistance, joined by requires another advancement paradigm" that fuses social and ecological objectives, and coordinates private, non-state performers and in this way their ability and aptitudes (Dunning, 2006). In any case, the pattern towards arrangements that include public and private actors may likewise give chances to linkages between climate change and sustainable development objectives.

2. Sustainable Agriculture Development: Working where it matters most.

Climate change rose as a point of discussion from crafted by characteristic researchers (Agrawala, 1998), while sustainable development was presented as a move towards principally social enhancements epitomized in the Brundtland report by the require "a future that is more prosperous, all the more just, and more secure" (1987, p. 1)

Sustainable development might be portrayed as a "basically challenged idea" (Gallie, 1956). Since the presentation in the late 1980's, its significance has been examined and tested generally. The distinctive understandings have been drastically disparate, raising doubt about whether it is one and a similar idea that has been examined. We discover understandings of practical improvement as 'proceeded monetary development' (Beckerman, 2003).

Sustainable development utilized for the most part in farming is the one in the tale 'Our Common Future' of the United Nations World Commission on Environment and Development (WCED), otherwise called the Brundtland report, which expresses that development which addresses the issues of the nearby without trading off the capacity of future ages to address their very own issues' (WCED, 1987). After some time, farmers have balanced farming frameworks and practices to meet changing financial and physical conditions by receiving new innovations, changing yield blends and institutional game plans. Such adaptability proposes a human potential to adjust to climate change (CAST, 1992; Rosenberg, 1992). Changes in temperatures and precipitation designs and an expansion in carbon dioxide (CO₂) levels are required to influence Agriculture, particularly in tropical locales.

The International Institute for Sustainable Development has characterized the idea for Sustainable Development as "A progression which addresses the issues of the current without compromising the ability of coming times to address their own issues. It contains two key highlights: the idea of necessities, specifically the fundamental needs of the world's poor, to which abrogating need ought to be given, and the possibility of impediments forced by the condition of innovation and social association on nature's capacity to meet present and future needs". Notwithstanding these, there are hundreds, if not thousands, of various examinations and endeavors to characterize, or possibly operationalized .On the environment's capability to meet current and future needs". In addition to these, there are hundreds, if not thousands, of different analyses and attempts to define, or at least operationalized.

3. Elements of Sustainable Agriculture.

Intrinsic in the thought of practical Agriculture is "its adjustability after some time to respond to the requests for nutrition and fiber (both high and low), its requests on characteristic assets for creation, and its capacity to ensure the dirt and the asset" (Tyrczniewicz, and Wilson 1995: p. 108).

Supportable farming isn't only an arrangement of practices yet it requires abilities of flexibility (Milestad and Darnhofer, 2003). The nearness or

absence of such adjustment aptitudes is a major determinant of how weak a particular framework is to outer or inside anxieties, for example, Climate change. With regards to climate change, flexibility is regularly alluded to as "flexible limit," characterized as, "the aptitude of a structure to be conventional to environmental change (counting climate changeability and boundaries) to direct potential harms, to exploit openings, or to adapt to the outcomes" (McCarthy et al., 2001: p. 21). In the dialect of sustainability, the more versatile limit a framework has, the stronger it is the framework keeps up its respectability in spite of worries from interior and outer elements and henceforth is more practical. (Costanza et al.1992)

4. Agriculture Adaptation to Climate Risks.

Adaptation in Agriculture in context of weather variations is a moderately latest field. The set methodology (regularly called the "situation approach") for distinguishing conceivable adjustment rehearses starts with weather alteration situations (i.e., conceivable coming weather situation) which, thus get from General Circulation Models (GCMs) and spotlights on evaluated impacts (Wall et al., 2004). Adaptation to environment change is not simply discrete specialized measures, but rather are alterations to cultivate rehearses regarding numerous (climatic and non-climatic) improvements and conditions. Environment change adjustment alludes to alterations in administration procedures to real or anticipated weather conditions or their belongings, with the end goal to lessen hazards or acknowledge openings (Smit et al., 2000b).

Likewise with numerous manageability contemplates the weakness approach verifiably recognizes that cultivating frameworks are very coordinated. Producers once in a while adjust creation or administration rehearses exclusively to lessen climate and climate dangers. Rather, climate related adjustments shape some portion of producer's general hazard administration procedure and fluctuate as per cultivate sorts and areas (Wandel and Smit, 2000). Numerous choices depend straightforwardly on government activities and projects, innovation improvement, and budgetary open doors past the homestead entryway (Smit and Skinner, 2002).

5. Sustainable Development and Climate Change: Towards an Integrated Approach.

Adjusting to weather changes means taking the appropriate steps to reduce the depressing impacts of environmental change (or to enterprise the affirmative steps) by systematic appropriate changes and improvements.

Extraordinary warmth, surges, dry spells, hail, and windstorms are a portion of the immediate impacts of weather change. Agriculturists are now adjusting to the changing climate by altering their choice of products and the planning of their field tasks with following strategies:

5.1 Diversification of Crops.

- Farmer must develop more lasting yields, in this way enhancing dry season resistance by upgrading soil quality and dampness maintenance.

- Where possible, a few farmer's must re-present local grasses for feeding which are dry spell safe when revolving munching is honed on them.

- Numerous grassland makers are moving far from strong wheat generation and growing a wide assortment of new harvests (e.g., beats) which are drier season safe.
- Mixed variety of product composes and assortment are developed in turn and in various zones of cultivate properties. This spreads the danger of losing a whole year's generation since conditions can shift crosswise over genuinely little regions and diverse harvests differ by the way they react to those conditions.

- Dates by picking an assortment of harvests that necessitate a scope of developing circumstances so that yields are at various stages (and subsequently pretty much powerless) if and when.

5.2 Diversify Enterprises inside one Farming Operation.

Campbell et al. (2002) add to their very own illustration of diversification by isolating it into two subcategories, agrarian and non-rural. Rural enhancement incorporates the presentation of extra cultivating endeavors for instance hamburger dairy cattle, aquaculture or tomato developing). Non-rural enhancement, then again, includes consolidating non-cultivating action onto the ranch business for instance cultivate based convenience, on-cultivate preparing of nourishment, renting land for non-farming purposes or esteem adding to existing undertakings.

5.3 Land Resource Management.

- Preservation practices of farmers were referred as encouraging results for lessening dangers from dry season. These were lessening soil disintegration; improving dampness maintenance; and limiting soil impaction.
- Preservation culturing is additionally credited with constraining harm from spillover and wash outs amid flooding.
- Some producers are adding new shelterbelts in addition to the improvement of the old ones. Such practices will help in reducing the harmful effects of dry season and will not let the underground water table becoming low, expanding biomass in earth, and guaranteeing shell dampness is kept on the land. These shelterbelts likewise give insurance from warmth and twist for animals, and can expand the warmth units in neighboring fields improving spring dampness levels in the dirt.

5.4 Water Resource Management.

- The water shortage is prompting more eagerness for water system.
- Few producers are working with latest technology, more proficient frameworks to avoid the waste of precious water.
- Swamps and lakes are made with the sense of how to ensure water is caught and guaranteed to such a degree as could be expected under the circumstances.

5.5 Integrated pest administration.

Coordinated pest administration is a blend of pest control techniques for perceiving and watching pests in the essential stages. It is important to understand that all pests are not unsafe. It is also important to allow them a chance to exist with the crop than burn through cash supply. This will empower the producers with spraying pests on the picked domains yet will likewise shield natural life from getting impacted.

5.5 Crop Rotation.

Crop Rotation is a very old technique used by the farmers. This keeps the soil solid and nourishing. The products are chosen in an example with the goal that the harvests planted this season renew the enhancement and salts from the earth that were utilized by the past yield cycle.

5.6 Avoid Soil Erosion.

Solid soil is a main to a proper yield. Archaic methods like working the land, furrowing and so forth still work ponders. Fertilizer, manures, cover crops and so forth additionally help enhance soil quality. Crop rotation keeps the event of diseases in yields. Many insects can be controlled through harvest revolution systems.

5.7 Crop Diversity.

Farmer's can expand assortment of a similar crop yielding little yet significant difference among the plants. This will help in money related problem being faced by the farmers. This system is called trim assorted variety and its reasonable make use of its on a down slip.

5.8 Natural Pest Eliminators.

Bats, winged animals, and so forth fill in as normal insect's eliminators. Farmer's fabricate safe house to keep these eliminators close. All types of bugs like ladybugs, insects, green lacewing hatchlings and fly parasites, aphids, vermin and nuisance are the main cause of damaging the fields. These insect eliminators are open in mass from pest control stores or developing supply shops. Producers can purchase and release them near to their farms so that they can make it as their home.

5.9 Managed Grazing.

The grazing lands for the cattle must be set aside in line of periodic shift. Shifting household animals present them a mixture of combing pastures. This entails that they will get different valuable benefits. The excreta of these animals fill up a bunch of quality for the land. Modification of region likewise counteracts soil dissolution as a similar fix of land isn't compressed upon recurrently. Timely contact and cutting the wild plant can be gotten at freedom before they create more seeds and duplicate.

5.10 Better Water Management.

The early period in water management is the basis of correct yields. It is also necessary to choose the local crops as they are more adaptable to the climate states of the area. Yields which required more water are decisive for dry zone. Farmers can assemble water collecting frameworks to store water and utilized it in dry season. Beside this city waste water can also be utilized for Agriculture purpose after purification.

5.11 Removal of Weeds Manually.

Small Farmer's can use their hand to remove weeds from their farms where machinery can't reach or in other case crops are very delicate. Farmers have also the option to blaze all the previous crop with the aim to destroy weeds and their seeds, but this will cause contamination in air.

6. Institutional issues and limit building.

A key obstruction to successfully addressing to climate change concerns is the absence of incorporated strategy making at worldwide, national or provincial and neighborhood levels of activity and among various government offices. For instance, in many developing nations, street transport, street development, vitality utilize and vehicular contamination are each represented by discrete divisions and services. So also, on account of adaptation, wellbeing services, foundation, and seashore front zone administration organizations should cooperate to supplement productivity given restricted assets and guarantee consistency with other arrangement needs. Spotlight ought to be on expanding the capacity of people in general division to survey, plan and actualize fitting approaches that fulfill economical advancement targets and, inside this unique circumstance, start to address climate change.

These proofs are accessible that climate has changed and the projections that climate will keep on changing later on underscores the need to comprehend agriculturist's observation and adjustment to climate change. Farmer's learning about climate change is a key and to a great extent figures out what techniques they embrace in their endeavor to lessen unfavorable impacts of climate change.

Agriculture is probably going to confront impressive strain to change its practices to end up more reasonable for type of weather change, both as far as alleviating outflows of carbon dioxide, nitrous oxide and methane, and in addition adjusting to the results of changes in climate effectively set up. The outcomes of type of weather change would be boundless, including objective changes to the scene and also expected changes in government necessities and market requests. There is an apparent earnestness for farming to change to relieve present ozone depleting substance emanations and to plan for future climate situations.

Climate change does not emphasize distinctly within the ecological or financial arrangement incentive of developing nations, yet proof demonstrates that the absolute most hostile impacts of climate change will be

in creating nations, where populaces are most unprotected and to the least extent likely to naturally adjust to environment.

Conclusion and Recommendation

Pakistan is under strain from climate stresses that raise vulnerability to facilitate environmental change by reducing capability of adaptation. The unfavorable impacts of environmental change have an especially devastating impact on Agriculture, which is the economic pillar of the country. Climate change has not only affected our food production but it is now basic cause of the widespread poverty. To mitigate the adverse impacts of climate change on agriculture it is mandatory that modern practices and integration should be used in agriculture to meet the food demand of rising population and increase farmer's income. As evident from the literature that obtaining sustainable agriculture needs insensitive knowledge, management skills and the participation of related organizations. For bringing such desirable changes it is mandatory to assess the behavior of the farmers in connection with the principles and concepts of sustainable agriculture. Moreover, enhancing and fortifying human capital, through instruction, effort, and extension administrations, enhances basic leadership limit at each level and builds the aggregate ability to adjust climate change impacts.

References

- Agrawala, Shardul, (1998). Context and Early Origins of the Intergovernmental Panel on Climate Change”, *Climatic Change*, 39: 605–20. 33.
- Adejuwon, S.A. (2004). Impact of climate variability and climate change on crop yield in Nigeria, Contributed paper to Stakeholders workshop on Assessment of Impact & Adaptation to Climate Change, pp. 2-8.
- Adams et al; (2010). “The role of agriculture in climate change: A preliminary evaluation of emission control strategies.” Conference of global change: economic issues in agriculture, forestry and natural resources. Washington 19-21 November 2010.
- Beckerman, Wilfred, (2003). *A Poverty of Reason: Sustainable Development and Economic Growth*, Oakland, CA: Independent Institute. 24, 41, 88 Beckerman.
- Commission on Environment, W. (n.d.).(1987) Bruntland. <https://doi.org/10.1002/jid.3380010208>

- CAST; (1992) Council for Agricultural Science and Technology. Preparing US agriculture for global climate change. Report 119. CAST, Ames, IA, 96 pp.
- Costanza, et al; (1992). Ecosystem Health: New goals for environmental management. Washington, DC Island Press. 269 pp
- Dunning, J. H. (2006). Towards a new paradigm of development: Implications for the determinants of international business. *Transnational Corporations*, 15(1), 173-227
- Gallie, W.B., (1956). Essentially Contested Concept”, *Proceedings of the Aristotelian Society*, 56: 167–98. 41, 52, 53.
- Hughton, D. (2002). Introduction to climate change: Lecture notes for meteorologists page 13-15.
- Kurukulasuriya,et al (2006a). Endogenous irrigation: the impact of climate change on farmers in Africa.CEEPA Discussion Paper No. 18. Centre for Environmental Economics and Policy in Africa. Pretoria, South Africa: University of Pretoria.
- McCarthy, et al; (2001). Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press: Cambridge, UK
- Morecroft et al; (2010). Responding to climate change: An essential component of sustainable development in the 21st century. *Local Economy* 25(3): 170–175.
- Milestad, R. and I. Darnhofer; (2003). Building farm resilience: The prospect and challenges of organic farming. *Journal of Sustainable Agriculture* 22(3): 81-97
- McCarthy et al; (2001). Climate Change 2001: Impacts, Adaptation, and Vulnerability: Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Rosenberg, N.J., 1992. Adaptation of agriculture to climate change. *Climate Change*, 21(4): 385-405.
- Smit et al; (2000b). An anatomy of adaptation to climate change and variability. *Climatic Change* 45: 223-251.

- Swart, R., Robinson, J., & Cohen, S. (2003). Climate change and sustainable development: expanding the options. *Climate Policy*, 3(Supplement 1), S19-S40
- Smit, B., Pilifosova (2001). Adaptation to climate change in the context of sustainable development and equity. *Impacts, Adaptation and Vulnerability. IPCC Working Group II. Cambridge University Press, Cambridge*, pp. 877–912.
- Smit, B. and M. Skinner. 2002. Adaptation options in agriculture to climate change: A typology. *Mitigation and Adaptation Strategies for Global Change* 7: 85-114.
- UNFCCC (2007). *Impacts, Vulnerabilities and Adaptation in Developing Countries, United Nations Framework Convention on Climate Change (UNFCCC), Bonn, Germany.*
- Walls and Maris (2006). “Agriculture and environmental.” MTT: Agrifood Research Finland.
- Youdeowei, et al; (1986) Introduction to tropical agriculture. Harlow: Longman Group. pp 1-5
- World Commission on Environment and Development (WCED)(1987) Brundtland report 7–8, 35–7, 83, 126, 246, 253; agriculture 153–6; economic growth 248; sustainable development definition 10, 11, 13, 237; urbanization 190
- Wilson, A. and A. Tyrchniewicz; (1995). *Agriculture and Sustainable Development: Policy Analysis on the Great Plains. International Institute for Sustainable Development, Winnipeg, Manitoba.* p. 108
- Wall et al; (2004). *Canadian Agrifood Sector Adaptation to Risks and Opportunities from Climate Change: A Position Paper. C-CIARN Agriculture, University of Guelph, Guelph, Ontario, Canada.*
- Wandel, J. and B. Smit. (2000). Agricultural risk management in light of climate variability. Pages 30-39. In: H. Millward, K. Beesley, B. Ilbery, and L. Harrington (Eds.). *Agricultural and Environmental Sustainability in the New Countryside. Hignell Printing Limited: Winnipeg,*