The Effects of Climate Change on the Mental Health of Smallholder Crop Farmers in Embu and Meru Counties of Kenya

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ABSTRACT

The weather patterns and climatic conditions have been changing over the last decades. Environmental psychosocial stresses associated with the effects of climate change are known to cause mental health issues such as depression and other mood disorders, anxiety, trauma, psychosis, substance abuse, ecological grief, relational problems, and psychological distress. The purpose of this study was to investigate the effects of climate change on the mental health of smallholder crop farmers in Embu and Meru Counties of Kenya. A sample of 400 smallholder farmers was determined using Yamane’s formula then participants selected using quota sampling. Data collection utilized the Self-Reporting Questionnaire 20-item (SRQ-20) to assess the mental health of the smallholder crop farmers and a researcher formulated questionnaire to assess the effects of climate change as well as the coping mechanisms utilized by the farmers to cope with the effects of climate change and mental illnesses. The results indicate that prevalence of mental health issues among smallholder crop farmers in Embu and Meru is at 35.2%. Correlational analysis shows that the mental health of smallholder farmers in Embu and Meru has been affected by climate changes. This study recommends that the government, agricultural agencies, and other private partnerships should help smallholder crop farmers with creative and innovative ways of dealing with climate change. Owing to the prevalence of mental illness among smallholder crop farmers, the study recommends that farmers proactively seek mental health services to help them in managing mental illnesses. Farmers should engage in seminars that train them on effective coping mechanisms to deal with climate change on one hand and mental illness on the other. Government and private entities, that are able to, could facilitate access to free or subsidized mental healthcare to smallholder crop farmers since most of these farmers cannot afford mental healthcare.
INTRODUCTION

A significant portion of the said changes is attributed to the steady increase in warm temperatures across the globe (Amano & Sutherland, 2013). Jaeschke et al. (2014) for instance note that from the examination of climate patterns, the temperature levels across the world have increased by 0.08 degrees Celsius each year since 1880. Clayton et al. (2017) cite that 449 cities across the world have taken a climate change risk assessment but the adequacy of these measures in protecting human mental health is uncertain hence more action is needed. Little has been done to understand and mitigate the climate change risk to health. According to this article, health and health-related adaptation funding in regards to climate change accounts for only 4.6% and 13.3% respectively of total global adaptation spending which is a very small percentage (Clayton et al., 2017).

There will be an increase in death rates of 250,000 per year from 165,000 between 2030 and 2050 due to the impacts of climate change globally (Clayton et al., 2017). The impact that causes the increased death rates according to this article includes heat related mortality, vector borne diseases, respiratory illnesses, and the commonly overlooked mental illnesses. Further, according to Page and Howard (2010), it was estimated that about 150,000 deaths were already occurring due to physical causes such as landslides and droughts which are visible effects of climate changes while the invisible effects are the health impacts of climate change. There is need to address the impact of climate change on health because the death rates are increasing and projected to get worse if nothing is done.

Farmers and other survivors that continuously experience adverse effects of climate change according to Hayes et al. (2018), experience complicated grief, recovery fatigue and may have suicidal ideations. According to Hayes et al. (2018), these negative effects may however inspire compassion for others, altruism, optimism in life, increase a sense of meaning, and personal growth from successfully dealing with the negative experiences caused by climate change. Yazd et al. (2019) state that farming is a stressful occupation and issues of climate change imply that farming will continue to become more stressful for farmers involved.

Africa is cited as the most vulnerable area to droughts induced by climate change because

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climate change has more impact in tropical regions of the world (Malhi et al., 2021). The impact of climate change is globally felt across private and public sectors and the issues of changes in agricultural productivity cut across these two sectors (Henderson et al., 2018). Serdeczny et al. (2016) also cite that Africa has been identified as a part of locations in the world most vulnerable to the impacts of climate change. The agricultural sector in Africa has greatly over the years depended on rainfall for farming and as climate changes occur, stresses associated with this will be on the rise. There has been correlation between high ambient temperatures and increased all-cause mortality in Ghana and Kenya due to the impact of climate change, which calls for action to deal with the impact of climate change on human health, mental health included (Serdeczny et al., 2016).

According to Ministry of Foreign Affairs (2018), Kenya is highly vulnerable to climate change and hence predisposed to the effects of climate change with the report ranking Kenya at 151 out of 181 countries for climate vulnerability. The current projections indicate that temperature in Kenya will rise by 0.25°C between 2000 and 2050 while at the same time rainfall will be less predictable and more intense. Adverse effects of climate change such as droughts will cause major threats to food security and water availability (Ministry of Foreign Affairs, 2018) thus causing mental health problems to farmers such as depression and anxiety.

From the foregoing, it is clear that climate change which affects the environment upon which farmers are able to effectively farm has shown some significant influence on the mental health of farmers. The mental health issues that have come to the fore more predominantly among farmers in the USA, UK, Canada, and countries in the Eastern hemisphere appear to be depression and anxiety (Hayes et al., 2018; Kumar et al., 2018; Yazd et al., 2019). Using the SRQ-20, issues of depression and anxiety will be examined to ascertain if they fall among the prevalent mental health issues that affect farmers in Eastern Kenya. This will be important because a closer look at the global (Hayes & Poland, 2018; Henderson et al., 2018), African (Dodgen et al., 2016; Yazd et al., 2019), and Kenyan (Kumar et al., 2018) studies have not shown any specific study done to examine the effect of climate change on the mental health of smallholder farmers in Kenya using a validated tool. Thus, the study sought to investigate the effects of climate change on the mental health of smallholder crop farmers in Embu and Meru Counties of Kenya.

**LITERATURE REVIEW**

**Theoretical Review**

Three appropriate theories and models are reviewed to anchor the study. These theories and models are: The Biopsychosocial-Spiritual Model, The Wellness Model, and The Sustainable Livelihoods Approach.

**The Biopsychosocial-Spiritual Model**

The Biopsychosocial-Spiritual Model is a modern theory most prominently espoused by Katerndahl (2008) as an expansion to the original Biopsychosocial model. The Biopsychosocial model was initially propounded by Engel (1977), a scholar of the psychosomatic movement. The basic premise of the Biopsychosocial model was that the health outcomes and status of human beings must be viewed after taking into account all the levels of human existence and development which basically include the psychological, biological, or physiological and social dimensions.

Borrell-Carrió et al. (2014) offers a more succinct description of the Biopsychosocial model when they asserted that this model intertwines the philosophical features of clinical care with the practical essence of a clinical guide. On a philosophical sense, it underscores the manner in which patient suffering, disease, and illnesses are predicated upon multiple layers of organization from the physiological, societal, and psychological
to the molecular. In a more practical sense, the Biopsychosocial model offers a way in which clinicians can recognize the patient’s subjective experience to be a key contributor to precise disease diagnosis, human care, and health outcomes.

While the Biopsychosocial model proposes the whole human being and his subjective experience as considerable features for proper health diagnosis and outcomes, there has been a need to fully make it as comprehensive as it supposes. To that extent, Katerndahl (2008) proposed the inclusion of the spiritual aspect into the Biopsychosocial model. This means that the general idea behind the model as presently constituted is that the health outcomes and status of human beings is best examined after considering not just the psychological, biological, or physiological and social dimensions but also the spiritual dimensions (Katerndahl, 2008).

Thus, the Biopsychosocial-Spiritual Model applies to the present study mostly because the examination of farmers’ mental health as affected by climate change will largely consider their subjective experiences based on the Self-Reporting Questionnaire 20-item (SRQ-20); an instrument that largely accesses subjective data (Andreou et al., 2011). Further, the basic elucidation of the measures of mental health that the study assumes affect farmers due to climactic changes which is a psychosocial stressor is predicated on the fact that the mental illness which is an indication of the absence of mental wellbeing is determined by forces that touch on various elements of the existence of the farmer; elements that include psychological, social, biological and even spiritual ones all of which form the gist of the Biopsychosocial-Spiritual Model.

**Wellness Model**

The Wellness Model is strongly aligned to the Biopsychosocial-Spiritual Model in so far as its exemplification of the human development dimensions as predictors of health are concerned. However, the Wellness Model argues that a holistic view of health in terms of physical, environmental, spiritual, financial, emotional, social, and intellectual wellness is needed to finally conclude that one is healthy (Stoewen, 2017). So, while the Biopsychosocial-Spiritual Model argues that health outcomes and status of human beings must be viewed after taking into account all the levels of human existence and development which basically include the psychological, biological, or physiological and social dimensions (Engel, 1977); the Wellness model looks at those levels as characteristics of a healthy human being (Kemp et al., 2017; Stoewen, 2017).

The Wellness Model aptly applies to the present study because the dimensions asserted include emotional dimension and intellectual dimension that cohere to most mental illnesses. Further, the climate change construct that constitutes the present study’s independent variables are environmental issues that fall within one of the primary dimensions of the Wellness Model. In that case, it can be said that the thrust of the present study which is to examine the effects of climate change on mental health of smallholder crop farmers in Eastern Kenya significantly aligns to the many dimensions of the Wellness Model in explaining the farmers wellbeing as well as in providing recommendations on the way forward; the extent of which the present study finds out.

**The Sustainable Livelihoods Model**

The Sustainable Livelihoods Approach, which was primarily developed by the Institute of Development Studies (IDS) in 1998, constitutes a framework of thinking about the nature, goals, objectives, and priorities attached to developmental actions (Serrat, 2017). It is focusses on evolving thinking regarding the manner in which vulnerable members of society and communities engage in livelihood actions as well as the actions and priorities set up to support them in those livelihoods (Kollmair & Gamper, 2012). Serrat (2017) argues...
that the Sustainable Livelihood Approach helps to facilitate the detection of practical priorities that lead to actions predicated upon the views and opinions of the people concerned but do not in themselves offer the panacea to all livelihood problems. Further, the approach is not meant to replace existing priority and objective actions like sector-wide approaches, participatory actions, integrated rural development actions or even devolved government initiatives (Flora & Flora, 2013). What it particularly asserts are that priority actions that touch on developmental progress must be multilevel in the sense that all relevant stakeholders from all stages of power are brought on board; must be people-centred to deal directly with those affected; must be participatory and responsive; should be done within a public-private partnership; must be dynamic and must be sustainable (Serrat, 2017).

The model is particularly aligned to the measures of the present study because climate change is part of the vulnerability context or the livelihood outcome that may either advance or hinder the livelihoods of smallholder crop farmers. Whichever practical priorities via policies and institutions that may be leveraged to help better deal with climate change depends on the ability of those actions to conform to the tenets of the SLA and must thus be holistic, participatory, sustainable, dynamic, within the partnership paradigm and people-centred. The present study will thus look at the climate changes and how it integrates with livelihood options and actions available to farmers.

**General Literature Review**

**Mental Health Status and Mental Illnesses Prevalence**

Studies have been done to examine the construct of mental health across the globe. The absence of mental health wellbeing leads to mental illnesses. Collier and Grant (2018) described mental illness as health conditions that comprise alterations, often negative in emotional, behaviour and thinking aspects or a combination of all three. Collier and Grant noted that mental illness is associated with stress or distress or disruptions in the social, work, and family engagements (Collier & Grant, 2018). Also, Woolfolk (2011) on his part noted that the mental illness construct is a complex aspect that touches on psychopathology, socio-cultural, and physiological aspects to the extent that no one definition does justice to it. However, the study observed that mental illness when viewed as a scientific or socio-political element is a harmful dysfunction of the general functioning of the mind, the emotion and behaviour that oscillate between the mild and the acute. Objectively therefore, the DSM-5 describes mental illness as a pattern of psychological syndromes that cause dysfunction, disability, distress, loss of autonomy, chances for death but which excludes basic deviant behaviour that are predicated on political or social reasons (Stein et al., 2010; APA, 2013).

As far as prevalence is concerned, recent reviews have shown that in developed countries like the UK, Canada, USA, and Germany, 19% which is about 1 in 5 people experience one form of mental illness in their lifetime and 4.1% which is approximately 1 in 24 people are basically diagnosed with some serious form of mental illness (Wainberg et al., 2017). The WHO (2018) global estimates show that in Africa, the prevalence rates of mental illness are approximately 17% and those diagnosed with mental illness is 3.3%. The report argues that one should not mistakenly assume that the figures are lower than those from developed countries because diagnosing capacities and the level of mental health awareness in Africa to engage in mental healthcare is significantly low and thus these figures could actually be higher. The same scenario as seen in Africa could be applied to Kenya where recent reports show that 1 in 4 Kenyans which translates to 25% suffer from one form of mental illness or the other (Government of Kenya, 2019; WHO, 2018). The reports further admit that owing to negative
attitudes about mental health in Kenya those reports could actually be higher.

Climate Changes

Climate change is threatening to be a defining element of social, economic, religion, politics, national stability, and cohesion. The unprecedented and unbridled national and international climate changes have created substantial havoc to the safety of national and global citizens and left governments grappling with what strategies to use to manage such dilapidating climate changes. The dynamics of climate change cover the broad spectrum of environmental degradation, climate and weather patterns, and associated actors that stretch from the local events, to international climate changes that have created the need for more discussions (Campbell, 2016; Collier et al., 2021). Climate change experts consider climate change as a complex construct that is sometimes difficult to define.

Nonetheless, climate has variously been defined as the synthesis of weather patterns in a given geographical location or context within a span of 30 years (Tol, 2020). Climate underscores the general mechanism of the climatic systems that consists of the hydrosphere, lithosphere, atmosphere, biosphere, and cryosphere that operate together after being powered by the solar radiation system (Shuaibu et al., 2014). It basically works in an equilibrium format where the noted elements balance each other in a meaningful and purposeful way as to create synergies and mechanisms that determine how the earth or the universe operates (Shuaibu et al., 2014; Tol et al., 2020). That said, climate changes are those alterations that occur when the equilibrium shifts as a result of changes in the power of solar radiation and changes in the structure of the components that constitute the climate force.

RESEARCH METHODOLOGY

The study was based on descriptive survey design along with correlational survey design. The study was done in Embu and Meru counties of Kenya. From both the Embu County and Meru County records of registered farmers, Embu has 677,876 farmers while Meru has 762,341 farmers (Embou County Records, 2021; Meru County Records, 2021). The county records show that 60% of these are smallholder farmers. This means that for Embu, the approximate number of smallholder farmers is 406,725 while for Meru is 457,404 smallholder farmers which gives a target population of 864,129 farmers. The sample size was determined using Yamane’s formula which provided a sample size of 400 smallholder crop farmers for the study (Yamane & Pázsit, 1998). Quota sampling technique was used to select the smallholder crop farmers from the large-scale farmers for this study, 200 participants being from Embu County and 200 participants from Meru County. Permission was obtained from the psychology department and the Institutional Review Board (IRB) United States International University-Africa (USIU-A) as well as the National Commission for Science, Technology, and Innovation (NACOSTI) for approval of this study.

The data collection process involved the use of a researcher formulated questionnaire to measure the effects of climate change and psychological testing done using the Self-Reporting Questionnaire 20-item (SRQ-20) to assess the prevalence of mental health issues among smallholder crop farmers in the study regions. Studies have shown that the SRQ-20 has a validity score of 0.714 in the Sholte et al. (2011) study done in Rwanda and 0.81 in the Kumbar et al. (2012) study done in India. This means that the tool is highly valid and reliable hence would serve the current study well. Consequently, data was analysed using descriptive and inferential statistical methods. The descriptive statistical tools included frequencies, percentages, means, and standard deviation that helped describe the effects climate change has on the mental health of...
smallholder crop farmers. Inferential statistics took
the form of a multiple regression analysis that tested
the level to which the DV (Mental health of farmers) was predicated by the IVs aligned to climate change
level.

RESULTS AND DISCUSSION

Prevalence of Mental Health Issues among Smallholder Crop Farmers

The study sought to ascertain the prevalence of mental health issues among smallholder crop farmers. The outcome is from the SRQ-20 results that was used to measure mental health of the smallholder crop farmers (Table 1).

Table 1: SRQ-20 Results

| Statements                                           | Yes (1) | No (0) |
|------------------------------------------------------|---------|--------|
| F          | %       | F      | %       |
| 1. Do you often have headaches?                      | 245     | 155    | 61.3   | 38.8 |
| 2. Is your appetite poor?                            | 145     | 255    | 36.3   | 63.7 |
| 3. Do you sleep badly?                               | 139     | 261    | 34.8   | 65.3 |
| 4. Are you easily frightened?                        | 133     | 267    | 33.3   | 66.8 |
| 5. Does your hands tremble?                          | 60      | 340    | 15.1   | 88.0 |
| 6. Do you feel nervous, tense, or worried?           | 168     | 232    | 42.1   | 58.0 |
| 7. Is your digestion poor?                           | 91      | 309    | 22.8   | 77.3 |
| 8. Do you have trouble thinking clearly?             | 212     | 188    | 53.0   | 47.0 |
| 9. Do you feel unhappy?                              | 33      | 367    | 8.3    | 91.8 |
| 10. Do you cry more than usual?                      | 187     | 213    | 46.8   | 53.3 |
| 11. Do you find it difficult to enjoy your daily activities? | 185 | 215 | 46.3 | 53.8 |
| 12. Do you find it difficult to make decisions?       | 181     | 219    | 45.3   | 54.8 |
| 13. Is your daily work suffering?                     | 188     | 220    | 45.1   | 55.0 |
| 14. Are you unable to play a useful part in life?     | 163     | 237    | 40.8   | 59.3 |
| 15. Have you lost interest in things?                 | 68      | 332    | 17.0   | 83.0 |
| 16. Do you feel that you are a worthless person?      | 37      | 363    | 9.3    | 90.7 |
| 17. Has the thought of ending your life been on your mind? | 137 | 263 | 34.3 | 65.8 |
| 18. Do you feel tired all the time?                   | 94      | 306    | 23.5   | 76.5 |
| 19. Do you have uncomfortable feelings in your stomach? | 197 | 203 | 49.3 | 50.7 |
| 20. Are you easily tired?                            | 163     | 237    | 40.8   | 59.3 |
| Average Total                                        | 141     | 173    | 35.2   | 64.9 |
| Prevalence %                                          |         |        |        | 35.2 |

\[ P\% = \frac{141}{400} \times 100 = 35.2 \]

The above average was corroboratively used with a cut-off of 7 on the SRQ-20 to assess the number of smallholder crop farmers experiencing mental health issues. Based on the results from the SRQ-20, the prevalence of mental health issues among smallholder crop farmers in Embu and Meru stood at 35.2%. Basically, 35.2% possessed symptoms that reflect anxiety, psychosomatic discomfort, and depression which cumulatively get grouped into the common mental disorder (CMD). The description of feelings, emotions, and behaviour by the smallholder farmers was congruent to the markers presented in the SRQ-20 and as such, it can be
concluded that mental health issues are prevalent among smallholder farmers in Embu and Meru.

Effects of Climate Change on the Mental Health of Smallholder Crop Farmers

The study sought to establish the effects of climate change on the mental health of smallholder crop farmers. To do this, a regression analysis was done to test the level to which the DV (Mental health among smallholder farmers) is predicated by the IVs aligned to climate change level.

Table 2: Model Summary

| Model | R  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | Durbin-Watson |
|-------|----|----------|-------------------|---------------------------|------------------|---------------|
|       | .126<sup>a</sup> | .576 | .514 | .084 | .016 | 61.468 | 1 | 398 | .001 | 1.489 |

<sup>a</sup> Predictors: (Constant), Climate change

Based on the results of the model summary, the R value of .126<sup>a</sup> shows a positive direction of the model which shows that the results are statistically significant (.126<sup>a</sup>p-value=<.005). Applicable to the present study is the adjusted R square which is .514 which represents the result that climate change predicted mental health outcomes among smallholder farmers in Embu and Meru at 51.4%. The fact that the p-value is .001 <0.05 shows that the result is statistically significant and that climate change had a significant effect on mental health of smallholder crop farmers in Embu and Meru.

Table 3: ANOVA

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|-------|----------------|----|-------------|---|------|
| 1     | Regression 1.518 | 1 | 1.518 | 61.468 | .001<sup>b</sup> |
|       | Residual 93.419 | 398 | .235 |   |     |
|       | Total 94.938 | 399 |   |   |     |

<sup>a</sup> Dependent Variable: Mental health
<sup>b</sup> Predictors: (Constant), Climate change

The ANOVA result (Table 3) shows an F-statistics of 61.468 which indicates that the model is fit and statistically significant. To that extent, climate change had a significant effect on the mental health of smallholder crop farmers in Embu and Meru.

Table 4: Coefficients
Table 4: Regression estimates of mental health among smallholder farmers in Embu and Meru

| Model | Unstandardized Coefficients | Standardized Coefficients | t | Sig. | 95.0% CI for B |
|-------|-----------------------------|---------------------------|---|------|---------------|
| 1 (Constant) | -0.023 | .251 | .090 | .928 | .516 | .871 |
| Climate change | .533 | .052 | .526 | 2.543 | .001 | .030 | .235 |

The results from Table 4 shows that at p-value 0.01 and a beta of .526, it can be concluded that climate change had a significant effect on the mental health of smallholder crop farmers in Embu and Meru. The confidence interval (CI 51.6%-87.1%) implies that the result that climate change had a significant effect on mental health of smallholder farmers in Embu and Meru is reliable and valid.

The prevalence rate of 35.2% means that the respondents possessed symptoms that reflect anxiety, psychosomatic discomfort and depression which cumulatively get grouped into the common mental disorder (CMD). This is an indication that mental health issues are prevalent among smallholder crop farmers in Embu and Meru. Looking at relevant literature, as far as prevalence is concerned, recent studies done in parts of Europe and the USA show 19% prevalence rate of mental illnesses and a 4.1% prevalence rate of diagnosed mental illness which is 1 in 5 and 1 in 24 people respectively (Wainberg et al., 2017). The WHO (2018) global estimates show that in Africa, the prevalence rates of mental illness are approximately 17% and those diagnosed with mental illness is 3.3%. The report argues that one should not mistakenly assume that the figures are low than those from developed countries because diagnosing capacities and the level of awareness of Africans to engage mental treatment is significantly low and thus these figures could actually be higher. In Kenya, the prevalence of mental health has been placed at 25% (Government of Kenya, 2019; WHO, 2018). The reports further admit that owing to negative attitudes about mental health in Kenya those numbers could actually be higher.

It should be noted that the prevalence of 35.2% of mental health issues in Embu and Meru counties in this study is significantly higher than most estimates globally, in Africa and in Kenya. However, what the prevalence highlights is that cumulatively, anxiety, psychosomatic discomfort, and depression are mental issues that significantly confront smallholder crop farmers in Embu and Meru. Further, the SRQ-20 and the results presented show that the biological, psychosomatic, psychological, and social dimensions were examined which led to the conclusion that mental issues were prevalent among the smallholder farmers in Embu and Meru. This aligns with the Biopsychosocial model which is the anchor theory in this study. The basic premise of the Biopsychosocial model was that the health outcomes and status of human beings must be viewed after taking into account all the levels of human existence and development which basically include the psychological, biological, or physiological and social dimensions (Borrell-Carrió et al., 2014; Engel, 1977).

The result that climate change had a significant effect on mental health of smallholder farmers has support from reviewed literature. Padhy et al. (2015) noted that climate change does indeed cause mental illness, as measured using stress and depression of farmers. However, the study was done in the Indian context and used the Perceived Stress Questionnaire while the present study examines the Kenyan context where differences exist in climate change and response to those changes. Further, the present study being that it is more concerned with examining mental health chooses to use the Self-Reporting Questionnaire- 20 Item to access data that measures mental health of smallholder crop farmers.

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farmers. This study is supported by Hayes et al. (2018) who examined the link between climate change and mental disorders among farmers in the UK. The study found a strong positive correlation between climate change and increased mental disorders among farmers than among non-farmers; that study used the Patient Stress Questionnaire to ascertain this outcome.

CONCLUSION

The prevalence of mental health issues among smallholder crop farmers in Embu and Meru stands at 35.2%; which is a significant prevalence. Also, climate change had a significant effect on the mental health of smallholder crop farmers in Embu and Meru. This has affected the wellbeing of these farmers based on the dimensions of the wellness model and the sustainable livelihood approach. The explanation of causes, diagnosis, and treatment of these mental health challenges that the smallholder farmers are facing are explained using the biopsychosocial- spiritual and wellness model while the sustainable livelihood approach touches on the effects of climate change and how these effects combined with mental health issues affect the livelihood actions of these smallholder crop farmers. This study recommends that: Owing to the significant prevalence of mental illness among smallholder crop farmers, it is recommended that the farmers should proactively seek mental health services to help them better manage mental illnesses. Public and private partnerships should be encouraged in the mental health field to help in setting up mental health centres in Embu and Meru to help increase access to mental healthcare for smallholder crop farmers. Institutions and individuals that are able to provide pro bono or subsidized mental healthcare to the smallholder crop farmers who are limited in resources and in their ability to afford psychotherapy should find a way of providing mental health services to the farmers. The farmers could also visit level 5 hospitals or county offices near them to benefit from seminars or workshops that train them on effective coping mechanisms. Consequently, aspects like mindfulness, resilience, and self-efficacy should be introduced to smallholder farmers for consequent effective practice. In provision of these mental health services, the goal should be to ensure that the smallholder farmers have holistic wellbeing in line with the assertions of the biopsychosocial-spiritual and the wellness models.

REFERENCES

Amano, T., & Sutherland, W.J. (2013). Four barriers to the global understanding of biodiversity conservation: wealth, language, geographical location, and security. *Proc R Soc B* 280, 2012-2649.

American Psychiatric Association (APA) (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th Ed.). American Psychiatric Publishing. USA.

Andreou, E., Alexopoulos, E.C., Lionis, C., Varvogli, L., Gnardellis, C., Chrousos, G.P., & Darviri, C. (2011). Perceived Stress Scale: Reliability and Validity Study in Greece. *Int. J. Environ. Res. Public Health*, 8, 2-3. https://doi.org/10.3390/ijerph8083287

Borrell-Carrió, F., Suchman, A.L., & Epstein, R.M. (2014). The biopsychosocial model 25 years later: principles, practice, and scientific inquiry. *Ann Fam Med*, 2(6), 576-82.

Campbell, J. (2016) Climate-Change Migration in the Pacific. *The Contemporary Pacific*, 26(1), 1-28.

Clayton, S., Manning, C., Krygsman, K., & Speiser, M. (2017). Mental health and our changing climate: Impacts, implications, and guidance. www.apa.org.

Collier, S. J., Elliott, R., & Lehtonen, T. K. (2021). Climate change and insurance. *Economy and Society*, 50(2), 158-172.
Dodgen, D., Donato, D., Kelly, N., La Greca, A., Morganstein, J., Reser, J., Ruzek, J., Schweitzer, S., Shimamoto, M., Tart, K. & Ursano, R. (2016). The impacts of climate change on human health in the United States, a scientific assessment. *U.S. Global Change Research Program*, 2-8.

Embu County Records, (2021). Embu County Government. Retrieved from https://www.embu.go.ke/

Engel, G.L. (1977). The need for a new medical model: a challenge for biomedicine. *Science*. 196(4286), 129-36.

Flora, CB & Flora, JL (2013). *Rural communities: Legacy and change* (4th edn). Boulder, CO: Westview.

Government of Kenya (2019). Mental Health Task Force Report. Ministry of Health. Retrieved from https://www.health.go.ke/mental-health-taskforce-urges-government-to-declare-mental-health-a-national-emergency-nairobi-tuesday-july-7-2020/

Hayes, F., & Poland, D. (2018). The ozone component of global change: Potential effects on agricultural and horticultural plant yield, product quality and interactions with invasive species. *Journal of Integrative Plant Biology* 51, 337–51.

Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health: Risks, impacts and priority actions. *International Journal of Mental Health Systems*, 12(28), 1-3. https://doi.org/10.1186/s13033-018-0210-6

Henderson, R.M., Reinert, S.A., Dekhtyar, P., & Migdal, A. (2018). Climate change in 2018: Implications for Business. *Harvard Business School*, 317(32), 1-2.

Jaeschke, A., Bittner, T., Jentsch, A., &Beierkuhnlein, C. (2014). The last decade in ecological climate change impact research: Where are we now? *Die Naturwissenschaften, 101*. https://doi.org/10.1007/s00114-013-1132-4

Katerndahl, A. (2008). Impact of spiritual symptoms and their interactions on health services and life satisfaction, *Ann Fam Med.* 26(5), 412-20.

Kemp, H., Arias, A., & Fisher, Z. (2017). Social Ties, Health and Wellbeing: A Literature Review and Model. In: Ibáñez A., Sedeño L., García A. (eds) *Neuroscience and Social Science*. Springer, Cham. https://doi.org/10.1007/978-3-319-68421-5_17

Kollmair, M., & Gamper, St. (2012). The Sustainable Livelihood Approach. Input Paper for the Integrated Training Course of NCCR North-South. Development Study Group. University of Zurich

Kumar, P., Tokas, J., Kumar, N., Lal, M. & Singal, H.R. (2018). Climate change consequences and its impact on agriculture and food security. *International Journal of Chemical Studies, 6* (6), 2-6.

Malhi, Y., Franklin, J., Seddon, N., Solan, M., Turner, M. G., Field, C. B., & Knowlton, N. (2020). Climate change and ecosystems: Threats, opportunities and solutions. *Philosophical Transactions of the Royal Society B*, 375(1794), 20190104.

Meru County Records, (2021). Public Records: Meru County Government. Retrieved from https://meru.go.ke/public-records/

Ministry of Foreign Affairs (2018). Climate change profile Kenya. http://www. mfa.go.ke.

Padhy, S. K., Sarkar, S., Panigrahi, M., & Paul, S. (2015). Mental health effects of climate change. *Indian journal of occupational and..."
environmental medicine, 19(1), 3-7. https://doi.org/10.4103/0019-5278.156997

Page, L.A., & Howard, L. (2010). The impact of climate change on mental health (but will mental health be discussed at Copenhagen?). Journal of Psychological Medicine, 2-4. https://doi.org/10.1017/S0033291709992169

Serdeczny, O., Adams, S., Baarisch, F., Coumou, D., Robinson, A., Hare, W., Schaeffer, M., Perrette, M., et al. (2016). Climate change impacts in Sub-Saharan Africa: From physical changes to their social repercussions. Journal of Regional Environmental Change, 15 (8), 4-5. https://doi.org/10.1007/s10113-015-0910-2

Serrat O. (2017). The Sustainable Livelihoods Approach. In: Knowledge Solutions. Springer, Singapore. https://doi.org/10.1007/978-981-10-0983-9_5

Scholte, W. F., Verduin, F., van Lammeren, A., Rutayisire, T., & Kamperman, A. M. (2011). Psychometric properties and longitudinal validation of the self-reporting questionnaire (SRQ-20) in a Rwandan community setting: a validation study. BMC medical research methodology, 11(1), 1-10.

Shuaibu, H., Akpoko, G., & Umar, S. (2014). Farm Households’ Coping Strategies to Climate Change: A Review. British Journal of Applied Science & Technology 4(20): 2864-2877.

Stein, D. J., Phillips, K. A., Bolton, D., Fulford, K. W., Sadler, J. Z., & Kendler, K. S. (2010). What is a mental/psychiatric disorder? From DSM-IV to DSM-V. Psychological medicine, 40(11), 1759–1765. https://doi.org/10.1017/S0033291709992261

Stoewen, L. (2017). Dimensions of wellness: Change your habits, change your life. The Canadian veterinary journal = La revue veterinaire canadienne, 58(8), 861–862.