English Abstract

One of the pressing challenges facing modern society is climate change, driven by human activities such as deforestation, fossil fuel consumption, and industrial emissions, leading to extreme weather events, biodiversity loss, and food insecurity. This global crisis disproportionately affects vulnerable populations in developing regions, exacerbating inequality.

Recent assessments from 2025 confirm the severity of these impacts: global temperatures remained exceptionally high, with 2025 ranking as one of the warmest years on record despite some cooling influences like La Niña. Extreme events—including deadly heatwaves, catastrophic floods (e.g., in Central Texas claiming over 138 lives), prolonged droughts, wildfires, and intensified storms like Hurricane Melissa—occurred across continents, claiming lives, destroying communities, wiping out crops, and causing cascading effects on food and water systems. Over 600 million people are projected to face acute food insecurity by 2030 if trends continue, with erratic weather already reducing crop yields in regions from Australia to India. Biodiversity continues to decline sharply, and vital planetary signs show worsening trends, underscoring that every fraction of a degree of avoided warming significantly reduces risks of crossing tipping points.

A viable solution involves transitioning to renewable energy sources like solar and wind, implementing reforestation programs, and fostering international cooperation through policies like carbon pricing and sustainable agriculture. By educating communities and incentivizing green innovations, societies can mitigate impacts and build resilience for future generations.

Progress in 2025 shows promising momentum in renewables: solar and wind together supplied over 17% of global electricity in the first three quarters, with renewables overtaking coal in many contexts for the first time. Solar PV led massive capacity additions (often doubling or more year-on-year in key regions), driven by falling costs, efficient permitting, and growing adoption in both utility-scale and distributed systems. China continued to lead deployments, while the EU achieved wind and solar surpassing fossil fuels in electricity generation in many countries. Battery storage expansions supported integration, helping meet rising demand (including from AI and digital growth) without proportional emissions increases. At current paces, tripling global renewables by 2030 remains achievable with sustained effort.

Reforestation initiatives also advanced in targeted areas, with diverse-species planting proving more resilient and successful in projects across Costa Rica, Colombia, India, and beyond. Global efforts aim to restore millions of hectares, enhancing carbon sequestration (potentially avoiding gigatons of emissions annually when combined with ecosystem protection like wetlands and mangroves), supporting biodiversity, and improving local water and food security through agroforestry.

Carbon pricing mechanisms expanded and evolved in 2025, covering more emissions through emissions trading systems (ETS)—which doubled in coverage since 2018—and taxes. China's national ETS extension to sectors like steel, cement, and aluminum boosted priced emissions toward 30-34% globally. These instruments increasingly support fiscal stability, innovation, and investment in developing economies, while flexible designs balance objectives like energy affordability and competitiveness. Emerging unilateral tools (e.g.,

border adjustments) highlight the need for balanced global approaches to avoid trade distortions.

To accelerate solutions, prioritize rapid scaling of renewables with grid upgrades and storage; enforce ambitious, diverse reforestation with community involvement and monitoring; expand carbon pricing revenues to fund just transitions and green tech; and strengthen international agreements for technology sharing and support to vulnerable nations. Collective, urgent action—combining policy, innovation, and education—can still limit warming, protect ecosystems, and ensure equitable resilience for future generations.

Kiswahili Abstract

Moja ya changamoto kubwa zinazokabili jamii ya kisasa ni mabadiliko ya tabianchi, yanayoendeshwa na shughuli za binadamu kama vile ukataji miti, matumizi ya mafuta ya kisukuku, na uzalishaji wa viwandani, na kusababisha matukio ya hali mbaya ya hewa, upotevu wa bioanuwai, na uhaba wa chakula. Mgogoro huu wa kimataifa unaathiri zaidi jamii dhaifu katika maeneo yanayoendelea, na kuongeza ukosefu wa usawa.

Tathmini za hivi karibuni za 2025 zinathibitisha uzito wa athari hizi: joto la dunia lilibaki juu sana, na 2025 likiorodheshwa kama moja ya miaka yenye joto zaidi kwenye rekodi licha ya ushawishi wa baridi kama La Niña. Matukio makali—ikiwemo mawimbi ya joto yanayoua, mafuriko mabaya (k.m. katika Texas ya Kati yaliyochukua maisha zaidi ya 138), ukame wa muda mrefu, moto wa misitu, na dhoruba zilizozidi nguvu kama Kimbunga Melissa—zilitokea katika mabara yote, zikichukua maisha, kuharibu jamii, kuangamiza mazao, na kusababisha athari zinazotiririka kwenye mifumo ya chakula na maji. Zaidi ya

watu milioni 600 wanakadiriwa kukabili uhaba wa chakula mkali ifikapo 2030 ikiwa mwenendo utaendelea, huku hali ya hewa isiyo ya kawaida tayari ikipunguza mavuno ya mazao katika maeneo kutoka Australia hadi India. Bioanuwai inaendelea kupungua kwa kasi, na ishara muhimu za sayari zinaonyesha mwenendo mbaya, ikisisitiza kwamba kila sehemu ndogo ya digrii inayozuilika ya joto inaweza kupunguza hatari za kuvuka pointi za kugeukia.

Suluhisho linalofaa linahusisha kubadilika kwenda kwa vyanzo vya nishati mbadala kama jua na upepo, kuanzisha mipango ya upandaji miti tena, na kukuza ushirikiano wa kimataifa kupitia sera kama bei ya kaboni na kilimo endelevu. Kwa kuelimisha jamii na kutoa motisha kwa uvumbuzi wa kijani, jamii zinaweza kupunguza athari na kujenga uimara kwa vizazi vijavyo.

Maendeleo ya 2025 yanaonyesha kasi ya kuahidi katika nishati mbadala: jua na upepo pamoja vilitoa zaidi ya 17% ya umeme wa dunia katika robo tatu za kwanza, huku nishati mbadala ikipita makaa ya mawe katika miktadha mingi kwa mara ya kwanza. Solar PV iliongoza ongezeko kubwa la uwezo (mara nyingi mara mbili au zaidi mwaka kwa mwaka katika maeneo muhimu), ikichochewa na gharama zinazopungua, ruhusa bora, na upanuzi wa kuongezeka katika mifumo ya kiwango cha matumizi na iliyosambazwa. China iliendelea kuongoza uwekaji, huku EU ikifanikisha upepo na jua kupita mafuta ya kisukuku katika uzalishaji wa umeme katika nchi nyingi. Upanuzi wa uhifadhi wa betri ulisaidia kuunganisha, kusaidia kukidhi mahitaji yanayoongezeka (ikiwemo kutoka AI na ukuaji wa kidijitali) bila ongezeko sawia la uzalishaji. Kwa kasi ya sasa, kuongeza mara tatu nishati mbadala duniani ifikapo 2030 bado inawezekana kwa juhudi endelevu.

Mipango ya upandaji miti tena pia iliendelea katika maeneo maalum, huku upandaji wa spishi mbalimbali ukithibitisha kuwa na uimara na mafanikio zaidi katika miradi katika Costa Rica, Colombia, India, na zaidi. Juhudi za kimataifa zinalenga kurejesha mamilioni ya hekta, kuimarisha uhifadhi wa kaboni (inaweza kuepuka gigatoni za uzalishaji kila mwaka ikichanganywa na ulinzi wa mfumo ikolojia kama ardhi oevu na mikoko), kusaidia bioanuwai, na kuboresha usalama wa maji na chakula wa ndani kupitia kilimo mseto (agroforestry).

Mifumo ya bei ya kaboni ilipanuka na kubadilika mwaka 2025, ikifunika uzalishaji zaidi kupitia mifumo ya biashara ya uzalishaji (ETS)—ambayo iliongezeka mara mbili katika ufunikaji tangu 2018—na kodi. Upanuzi wa ETS ya kitaifa ya China kwa sekta kama chuma, saruji, na alumini iliongeza uzalishaji ulio na bei kuelekea 30-34% kimataifa. Zana hizi zinazidi kusaidia utulivu wa fedha, uvumbuzi, na uwekezaji katika uchumi unaoendelea, huku miundo inayobadilika ikisawazisha malengo kama bei nafuu ya nishati na ushindani. Zana zinazoibuka za upande mmoja (k.m. marekebisho ya mpaka) zinaangazia hitaji la mbinu za kimataifa zenye usawa ili kuepuka upotofu wa biashara.

Ili kuharakisha suluhisho, weka kipaumbele kuongeza haraka nishati mbadala pamoja na uboreshaji wa gridi na uhifadhi; tekeleza upandaji miti tena wenye shabaha na ushiriki wa jamii na ufuatiliaji; panua mapato ya bei ya kaboni kufadhili mabadiliko ya haki na teknolojia ya kijani; na kuimarisha makubaliano ya kimataifa kwa kushiriki teknolojia na msaada kwa nchi dhaifu. Hatua ya pamoja na ya haraka—ikichanganya sera, uvumbuzi, na elimu—bado inaweza kupunguza joto, kulinda mifumo ikolojia, na kuhakikisha uimara wa usawa kwa vizazi vijavyo.

Kikuyu Abstract (Indigenous Kenyan Language)

Rĩrĩa rĩrĩ, thĩĩnĩ wa gĩthomo gĩa andũ a rũrĩrĩ rũa rĩu, thĩĩnĩ wa mathĩna marĩa marĩkũgũrũka nĩ **kũgũcokia gĩthaka (climate change)**, kũgĩa na wĩra wa andũ ta kũtemania mĩtĩ, kũhũthĩra mafuta ma thĩ (fossil fuels), na mĩtugo ya maindasĩtria marĩa marĩkũhũthia gĩthaka. Ũhũthĩro ũyũ nĩũkũrehithia mathĩna manene ta mĩthenya ya gũthũũra muno, gũtũũra kwa maaĩ, kũgũthũka kwa ndũrĩrĩ cia thĩ, na kũgũthũka kwa kĩrĩa gĩkũrũrũma (chakula). Mathĩna maya nĩmarĩkũhũthia muno andũ a bũrũri iria cianake, kũmenyithia ũthũngũri na ũndũgũ.

Ūhoro wa 2025 wamenyithirie atĩ mathĩna maya nĩmarĩ manene muno: gĩthaka kĩa thĩ gĩgĩtũũra kũgĩa gĩkũrũ, na mwaka wa 2025 wathomithirwo ta ũmwe wa miaka iria irĩ na gĩthaka gĩkũrũ muno, o na kana kwarĩ na ũndũ mũtĩkĩre ta La Niña. Mĩtugo mĩkũrũ ya gĩthaka—ta mĩthenya ya ũũgĩ muno wa kũrũma andũ, maaĩ manene marĩa marakũrũrũka (ta maũndũ marĩa mathiire Central Texas na kũhũthia mĩoyo ya andũ 138), kũgũthũka kwa maaĩ kwa ihinda rĩraya, mĩrĩmo ya mwaki, na mĩgũnda ya mũthũngũrũrũ ta Hurricane Melissa—nĩyakoretwo thĩ yothe. Maya nĩmarakũhũthia mĩoyo ya andũ, gũtũũra mĩciĩ, gũcinyia mĩgũnda, na kũrehithia mathĩna ma kũgĩa na maaĩ na kĩrĩa gĩkũrũrũma. Andũ marĩa marĩ igana magana itandatũ (600 million) magĩtũũra kũrĩa kũgũthũka kwa kĩrĩa gĩkũrũrũma mbere ya 2030 angĩkorwo mĩtugo ĩno itahindũkĩte. Rĩrĩa rĩu, gĩthaka gĩa mũthenya nĩgĩkũgũthũkia mĩgũnda bũrũri-inĩ nyingĩ kuuma Australia nginya India. Ndũrĩrĩ cia thĩ nĩcikũgũthũka muno, na ciama cia gĩthaka cia thĩ cionanagia atĩ mathĩna nĩmakũgũrũka, kũmenyithia atĩ o gĩthakũrũ kĩrĩa kĩtindĩkĩtio gĩkũrehithia kũhũthĩra mathĩna ma kũgũthũka kwa mĩtugo ya thĩ.

Njĩra ya gũhonokia nĩ kũhingia andũ kũrĩ **ngũgũ cia hinya iria itarĩ mĩhũthĩro**, ta hinya wa riũa na wa mhepo, gũtũũra na wĩra wa kũtũma mĩtĩ mĩingĩ, na gũtũũra hamwe bũrũri-inĩ yothe na mĩtugo ya mũtharaba ta kũhũthĩra carbon (carbon pricing) na gũrũma gĩthaka na kũrima kũrĩa kũtũũra (sustainable agriculture). Na kũmenyithia andũ na kũheana mĩrĩrĩro kũrĩ mĩtharaba ya gĩthaka gĩrĩa kĩrĩ na ũhoro, andũ mangĩhota kũgũthũkia mathĩna na gũtũũra na hinya wa kũhimania na mĩthenya ĩno igũũka.

Thibitari cia 2025 cionanagia mũno wa mũgambo mwega thĩĩnĩ wa ngũgũ cia hinya: hinya wa riũa na wa mhepo hamwe nĩwathomithirwo atĩ wahanĩte gĩcunjĩ kĩrĩa kĩrĩ igana rĩmwe na mũgwanja (17%) kĩa hinya wa magetha wa thĩ kũrĩa kwathomithirwo mĩthenya ya mbere ya mwaka. Ngũgũ cia hinya iria itarĩ mĩhũthĩro nĩciagĩkire gũthũka makaa (coal) thĩĩnĩ wa bũrũri nyingĩ. Solar PV nĩyo yathondekire kũgũcokia gĩthaka muno, igũtũũra gũkũrũma hinya muno mwaka ku mwaka kũrĩa gũtũũra na gũtũũra gĩcunjĩ kĩa hinya, gũkũrũma kwa gĩthima, na kũhingia andũ gũtũũra nayo thĩĩnĩ wa mĩciĩ na maindasĩtria. China

nĩyo yarĩ mbere muno thĩĩnĩ wa kũhingia hinya, rĩrĩa EU yakinyirie hinya wa riũa na wa mhepo gũthũka hinya wa mafuta thĩĩnĩ wa bũrũri nyingĩ. Gũtũũra kwa mabatiri ma hinya kwahingirie gũtũũra hamwe kwa hinya, gũkũrũma kũhũthĩra mahitaji mangĩa (o ta maũndũ ma AI na gũkũrũma kwa digital) ti hamwe na kũgũcokia mĩhũthĩro. Rĩrĩa mũtharaba ũyũ ũtũũra ũyũ, gũkũrũma hinya wa thĩ mara ithatũ mbere ya 2030 nĩgũtũũra gũhota kũgerio.

Mĩtharaba ya kũtũma mĩtĩ nayo yathondekire mbere thĩĩnĩ wa bũrũri ithui, kũmenyithia atĩ kũtũma mĩtĩ ya mĩringo mingi nĩkũrĩ na hinya muno na gũtũũra kũhimania. Wĩra ũyũ wonekire Costa Rica, Colombia, India, na bũrũri ingĩ. Mĩtharaba ya thĩ yothe nĩyĩkũhoya kũhonokia mahekta maingi, gũkũrũma kũhingia carbon thĩ (carbon sequestration), kũhota gũtindĩkĩra mĩhũthĩro ya gigaton nyingĩ mwaka-inĩ, kana hamwe na kũhonia mĩtugo ya thĩ ta wetlands na mangroves. Maya nĩmakũteithia ndũrĩrĩ cia thĩ, maaĩ, na kĩrĩa gĩkũrũrũma kũrĩ andũ a kũu hamwe na agroforestry.

Mĩtharaba ya kũhũthĩra carbon yathondekire gũkũrũma 2025, gũkũrũma gũhũthĩra mĩhũthĩro mingi na mĩtharaba ya gũtũũra na kũgũrũrũka (ETS) hamwe na mĩtharaba ya mĩhũthĩro. China yakinyirie ETS yake kũrĩ maindasĩtria ta chuma, simenti, na aluminum, gũkũrũma gũhũthĩra mĩhũthĩro gũkũrũka 30–34% thĩ yothe. Mĩtharaba ĩno nĩyĩkũteithia gũtũũra kwa mũno wa gũthikĩrĩria, gũthondeka ũhoro, na kũhingia mĩrĩrĩro thĩĩnĩ wa bũrũri iria cianake. Mĩtharaba ya gũcokereria mĩhũthĩro kũrĩ mĩtharaba ya bũrũri o na ũmwe (ta border adjustments) yamenyithirie atĩ gũkũrũma gũtũũra hamwe thĩ yothe nĩkwagĩrĩire gũtũũra na hinya mũno nĩguo gũtikũrehithia mathĩna ma thoko.

Nĩguo gũkũrũma gũhota gũhonokia, gĩtũmi kĩa mbere nĩ gũkũrũma hinya wa riũa na wa mhepo hamwe na kũhonokia mĩgũnda ya magetha na mabatiri; kũhingia mĩtharaba ya kũtũma mĩtĩ ya mĩringo mingi hamwe na andũ a kũu na gũthikĩrĩria; gũkũrũma kũhũthĩra mĩtharaba ya carbon kũteithia andũ a mathĩna na ũhoro wa gĩthaka gĩrĩa kĩrĩ na ũhoro; na kũhingia mũno wĩra wa thĩ yothe wa kũheana tekinolojia na gũteithia bũrũri iria ciarĩ mathĩna. Gũtũũra hamwe na wĩra wa kahora—kũhingia mũtharaba, ũhoro, na ũmenyithia—nĩgũhota gũtindĩkĩra kũgũcokia gĩthaka, kũhonokia ndũrĩrĩ cia thĩ, na kũhingia ũtũũro ũrĩa ũrĩ na gĩthima kũrĩ rũciaro rũrĩa rũgũũka.