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| Section | PRISMA Item | Details |
| Abstract | - | **Title:** Agroforestry Systems in Ethiopia: A Review of Climate Change Mitigation, Adaptation, and Sustainable Land Management Potential **Authors:** Daba Bogale (Corresponding Author) **Abstract:** This review evaluates the role of agroforestry in Ethiopia for climate change mitigation through soil health improvement and carbon sequestration. Using a meta-analysis approach, 54 studies from databases including Scopus, Web of Science, and AGRICOLA were analysed. Agroforestry systems like coffee-based systems were found to sequester 7.2 tons of CO₂ per hectare annually, while home gardens stored up to 150 tons of carbon per hectare. Agroforestry practices also enhanced soil fertility, food security, and income resilience. **Keywords:** Agroforestry, climate mitigation and adaptation, carbon sequestration. |
| Introduction | 3, 4 | **Rationale:** Climate change poses severe threats to ecosystems and agriculture in Ethiopia. Agroforestry, the integration of trees with crops and livestock, offers sustainable solutions for mitigating climate change impacts through carbon sequestration, enhanced soil fertility, and resilience to erratic weather patterns. **Objectives:** The review aims to: 1. Evaluate agroforestry systems' role in carbon sequestration. 2. Assess soil fertility improvement and resilience to climate variability. 3. Identify barriers and opportunities for scaling agroforestry practices. |
| Eligibility Criteria | 5 | **Inclusion Criteria:** Peer-reviewed articles, reports, and conference papers focusing on agroforestry systems (e.g., parklands, coffee-based systems, home gardens) related to climate change mitigation and adaptation. Studies published from 2000 onwards, addressing SOC, carbon sequestration, or food security. **Exclusion Criteria:** Studies lacking methodological clarity, not addressing both mitigation and adaptation, or grey literature without peer review. |
| Information Sources | 6 | Data was sourced from prominent databases such as Scopus, Web of Science, PubMed, Google Scholar, and AGRICOLA. Additional records were identified through reference lists of selected studies. |
| Search Strategy | 7 | Keywords and Boolean operators were used for comprehensive searches: - "Agroforestry AND climate change mitigation" - "Agroforestry systems AND climate adaptation" - "Carbon sequestration AND agroforestry" - "Resilience AND agroforestry practices." References from relevant studies were reviewed to ensure broad coverage. |
| Selection Process | 8 | Two independent reviewers screened titles and abstracts for relevance. Full texts of potentially eligible studies were reviewed for inclusion. Disagreements were resolved by a third reviewer. The process was visualized using a PRISMA flow diagram detailing the inclusion and exclusion criteria. |
| Data Collection Process | 9 | Data was extracted using a structured form capturing: - Study characteristics (location, agroforestry type) - Methodological details - Key outcomes, including SOC accumulation, carbon sequestration rates, soil fertility, biodiversity indices, and socio-economic benefits. |
| Data Items | 10 | The extracted variables included: - Carbon sequestration rates - SOC levels - Water retention metrics - Biodiversity indices - Socio-economic benefits (e.g., income diversification). |
| Risk of Bias Assessment | 11 | Study quality was assessed using the Critical Appraisal Skills Programme (CASP) checklist. Publication bias was evaluated using funnel plots and Egger's test. |
| Effect Measures | 12 | Key effect measures included: - Carbon sequestration rates (tons of CO₂ per hectare per year) - SOC levels (percentage increase) - Biodiversity indices (species richness) - Socio-economic impacts (income and yield stability). |
| Synthesis Methods | 13 | A combination of descriptive and quantitative synthesis was employed: - **Descriptive Synthesis:** Summarized themes related to agroforestry’s effectiveness. - **Quantitative Synthesis:** A random-effects model assessed the impact of agroforestry systems on SOC, carbon sequestration, and yield stability. Regional and agro-ecological trends were analyzed. |
| Reporting Bias Assessment | 14 | Funnel plots and Egger's test were used to evaluate reporting biases. Under-reported studies were considered in the qualitative synthesis. |
| Certainty Assessment | 15 | The GRADE approach assessed the certainty of evidence for each key outcome, including SOC improvement, carbon sequestration, and socio-economic benefits. |
| Discussion | 23-25 | **Summary of Evidence:** Agroforestry systems significantly enhance SOC, carbon sequestration, and soil fertility. Coffee-based systems in Sidama and home gardens in Gedeo store substantial carbon. Agroforestry improves income stability and food security. **Limitations:** Gaps in data for underrepresented regions, methodological variability, and potential publication bias. **Conclusions:** Recommend promoting agroforestry systems proven effective in Ethiopia and adopting global best practices to enhance resilience and land restoration. |
| Other Information | 26-28 | **Registration:** This review followed PRISMA guidelines but was not registered in a publicly accessible protocol registry. **Support:** No financial support or funding was received. **Competing Interests:** The authors declare no competing interests. |