

Sustainable bioenergy systems to restore and valorize degraded land

Key messages

- Fossil fuel-based energy supply is unsustainable; bioenergy is a viable alternative to address future societies' energy needs sustainably.
- Bioenergy production is an important component to a low-carbon and energy-secure future in the land-use sector in many countries, including Indonesia.
- In many cases, land use for energy crops has had detrimental effects – such as increased competition for arable land and water; and conversion of native vegetation to monocultures with vastly reduced biodiversity and increased greenhouse gas (GHG) emissions.
- Well-designed agroecosystems could produce fuel from plants grown on degraded and marginal land, which would contribute substantially to Indonesia's targets for biofuels, while minimizing negative environmental and social effects and stimulating local economies.
- The CIFOR/NIFoS research on bioenergy aims to assess the potential of bioenergy production on degraded land in Indonesia, and the merits and demerits of such systems, from economic, environmental and social standpoints – to assist decision-making by policymakers and investors.



Photo by Aulia Erlangga/CIFOR

Bioenergy as an emerging opportunity

The ability of plants to capture energy directly from the sun can be used to produce biofuels, which can produce electricity and/or fuels to replace nonrenewable energy sources. With appropriate planning and management, biomass-based energy (bioenergy) can be part of the solution to reduce global warming, while providing multiple socioeconomic and environmental benefits to rural communities. Bioenergy systems are expected to expand in Indonesia in the coming decades for a variety of reasons, such as: (i) they are viewed as more secure and sustainable than systems relying on imported fossil fuels; (ii) increasing economic growth is expected to increase overall national energy demand; (iii) favorable national policies and legislation are expected to encourage bioenergy production as a way of achieving energy security and self-sufficiency; (iv) technological advances will increase the affordability of bioenergy; and (v) properly managed bioenergy systems can potentially support rural development, and provide employment and environmental benefits.

In addition, Indonesia has significant potential for bioenergy production from degraded and marginal land, because of high availability of such land in several provinces, favorable climatic

conditions for a wide variety of bioenergy tree species and low labor costs. Furthermore, ongoing national and international demand for bioenergy is of particular interest to emerging countries such as Indonesia in terms of opportunities to develop economic growth and trade. However, the expansion of bioenergy plantations is a controversial issue in many parts of the world including Indonesia, and requires more research.

Opportunities

- Bioenergy can be produced from inedible plants that grow on land that is not well suited for agriculture, such as steep, degraded and abandoned lands.
- Careful utilization of degraded and abandoned lands to produce biomass can produce fuel without causing negative impacts on food crops and land degradation (commonly associated with bioenergy sectors in some regions).
- Forestry-based means of producing bioenergy (e.g. agroforestry, reforestation and afforestation) can help to address key environmental challenges, e.g. by reversing biodiversity loss, stabilizing land, reducing soil erosion and flooding and providing economic opportunities to rural communities.

Challenges ahead

- Bioenergy and food production can compete with each other for land, which may increase food commodity prices, hunger and food insecurity.
- Poorly planned bioenergy production can lead to further degradation of natural forests which can affect the livelihoods of people dependent on forests; this can increase land conflicts and reduce biodiversity.
- Increased use of insecticides and fertilizers to enhance biomass productivity may exacerbate environmental degradation and cause loss of biological control and water pollution to downstream communities.

This research will focus on the potential of bioenergy production systems on degraded and/or abandoned lands in Central Kalimantan. The outcomes of this study will be relevant to other regions of Indonesia and other tropical areas.

How this project will contribute to bioenergy research

Bioenergy research is in an emerging state in Indonesia. Several tree species have been identified as potential sources of bioenergy, but greater understanding is required of their suitability in degraded and marginal lands, energy properties and the most efficient energy conversion options. Investors and decision-makers require real-world tests of assumptions and uncertainties in national and local contexts.

This project will combine desk and field research, capacity development and stakeholder engagement at local and subnational levels and knowledge-sharing across areas and agencies. Research will be conducted over a 2-year period beginning in October 2015. The research is focused on biomass production on degraded peatlands in Pulang Pisau district in Central Kalimantan where a large part of the land of a major (ex) Mega Rice project currently remains as abandoned land.

Research

1. Evaluating the potential of bioenergy production on degraded land: This component involves gathering spatially explicit data on degraded land, environmental amplitude associated with tree species and site suitability, productivity and economic profitability, policy and legal instruments associated with tree planting for bioenergy production.
2. Action research and demonstration trials of key selected bioenergy tree species: This component involves testing several bioenergy tree crops in degraded peatlands, monitoring growth performance and associated productivity in Central Kalimantan.
3. Fuel and energy efficiency: This component will assess modern technology developed by NIFoS (National Institute of Forest Science) researchers to convert biomass to bioenergy. It will evaluate energy properties of appropriate tree species in degraded land and the efficiency of energy conversion options for various situations.

Stakeholder engagement and capacity building

The project will bring a diverse range of stakeholders together, such as rural communities, young researchers from local and international universities, and nongovernmental organizations. A series of knowledge-sharing workshops will be run; training and exchange visits will provide opportunities to develop the capacity of local researchers. Stakeholder engagement will ensure that the knowledge generated from research and demonstration trials feeds into policy processes for using degraded land for bioenergy production.

Knowledge-sharing

CIFOR's sophisticated approach to partner engagement and knowledge-sharing will play a vital role in facilitating positive national, subnational and local outcomes. The knowledge generated from CIFOR's bioenergy research will be disseminated through a variety of publications such as policy briefs, peer-reviewed papers, fact files, toolkits and multimedia (e.g. blogs, videos, infographics, etc.). Knowledge will be shared through workshops and seminars to target policy and decision-makers in an effort to help inform and shape national and subnational policies.

For additional information regarding the CIFOR/NIFoS bioenergy, please contact:

- Himlal Baral, CIFOR h.baral@cgiar.org
- Soo Min Lee, NIFoS lesoomin@korea.kr



RESEARCH
PROGRAM ON
Forests, Trees and
Agroforestry

This research was carried out by CIFOR as part of the CGIAR Research Program on Forests, Trees and Agroforestry (CRP-FTA). This collaborative program aims to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape from forests to farms. CIFOR leads CRP-FTA in partnership with Bioversity International, CATIE, CIRAD, the International Center for Tropical Agriculture and the World Agroforestry Centre.



Fund



cifor.org

blog.cifor.org



Center for International Forestry Research (CIFOR)

CIFOR advances human well-being, environmental conservation and equity by conducting research to help shape policies and practices that affect forests in developing countries. CIFOR is a member of the CGIAR Consortium. Our headquarters are in Bogor, Indonesia, with offices in Asia, Africa and Latin America.

