

SDGs through Biomass Technologies: Research, Development and Dissemination



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विषय-सूची

- पृष्ठभूमि: दिगो विकासका लक्ष्य, जैविक प्रविधि र नाष्टका प्रबिधि विकासका प्रयासहरु
- प्रबिधि विकासका चरण र प्रबिधि सचेतनाका भित्रका प्रयासहरु
- बयोचारको प्रयोग र फाइदाहरु
- सुझाव



विश्वको लक्षः दिग्गो विकास



SUSTAINABLE
DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



SUSTAINABLE
DEVELOPMENT
GOALS

दिगो विकासका पांच मन्त्र

जनता र जिबिका

पृथ्वी र सम्पदा



सहकार्य

समता र शान्ति

समृद्धि र विकास

दिगो विकासका तीन आयामः

- दिगो विकासको परिभाषा भित्र भविष्यको निरन्तरतामा कुनै सम्झौता नगर्ने गरि बर्तमानको आवस्यकताको परिपूर्ति पर्दछ।
- यो लक्ष्य भेट्न तीन आयामको संयोजन अति आवश्यक छः

आर्थिक वृद्धि, सामाजिक समावेशीकरण र बातावरण संरक्षण





Sustainable Nepal

- Considering the current size of economy, Nepal will have a big financing gap to meet the SDGs targets by 2030.
- Nepal needs technological support for SDGs implementation like the smart technology for small-scale agro-based entrepreneurs and low carbon emission engineering for industrial outputs.
- Nepal needs capacity building in these areas therefore it has strengthened the partnership with private sector, cooperatives, civil society organizations, development partners and international community.
- **Goal 17-Means of SDGs implementation:** Four components like **finance, technology, institutions, capacity and partnership** are vital means of SDGs implementation. These components have synergy effect as one component complements and supplements to another.



Problem 1:

Under Exploitation of Resources



Unmanaged Land



Unused land in every community besides deforested natural resources land



Unaccounted mining

natural resources



Outgoing Human resources



Major Problem Bioenergy:

Farming Practices Comparison



Industrial processing



Fun/ Passion/
academic career



**Cost
Comparison?
??**

बैज्ञानिक ज्ञानको चरण र स्वरूपहरु

बिज्ञान

Science

प्रविधि

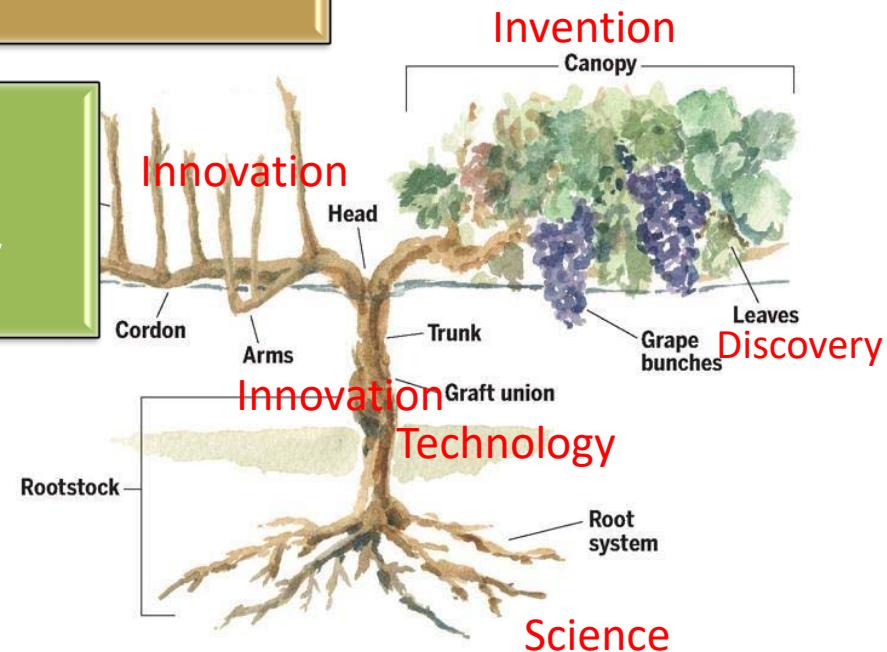
Technology

नवप्रवर्तन

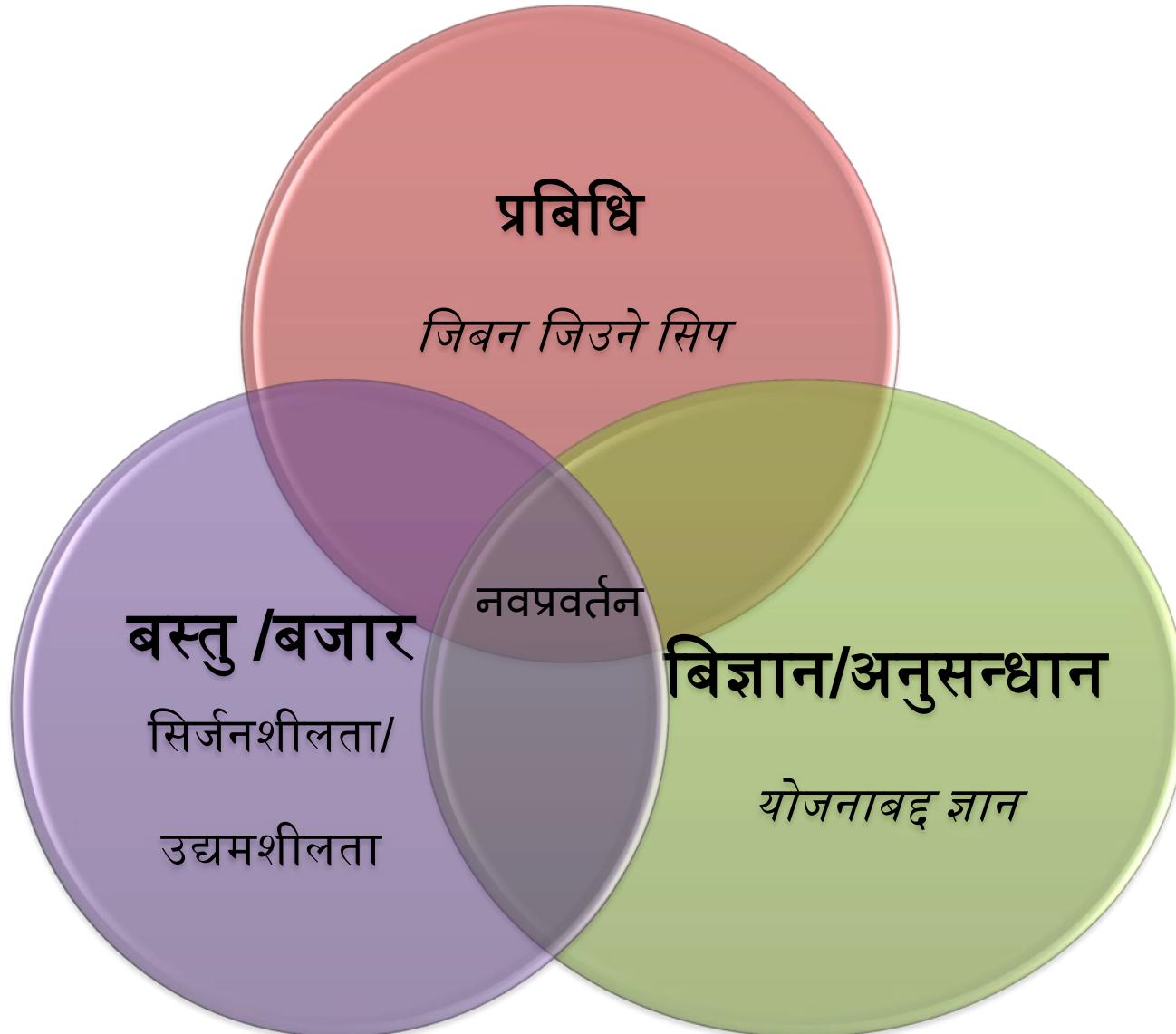
Innovation

आविस्कार
Invention

खोजी
Discovery



नवप्रवर्तनः ज्ञान, बजार र सिपको संयोजन

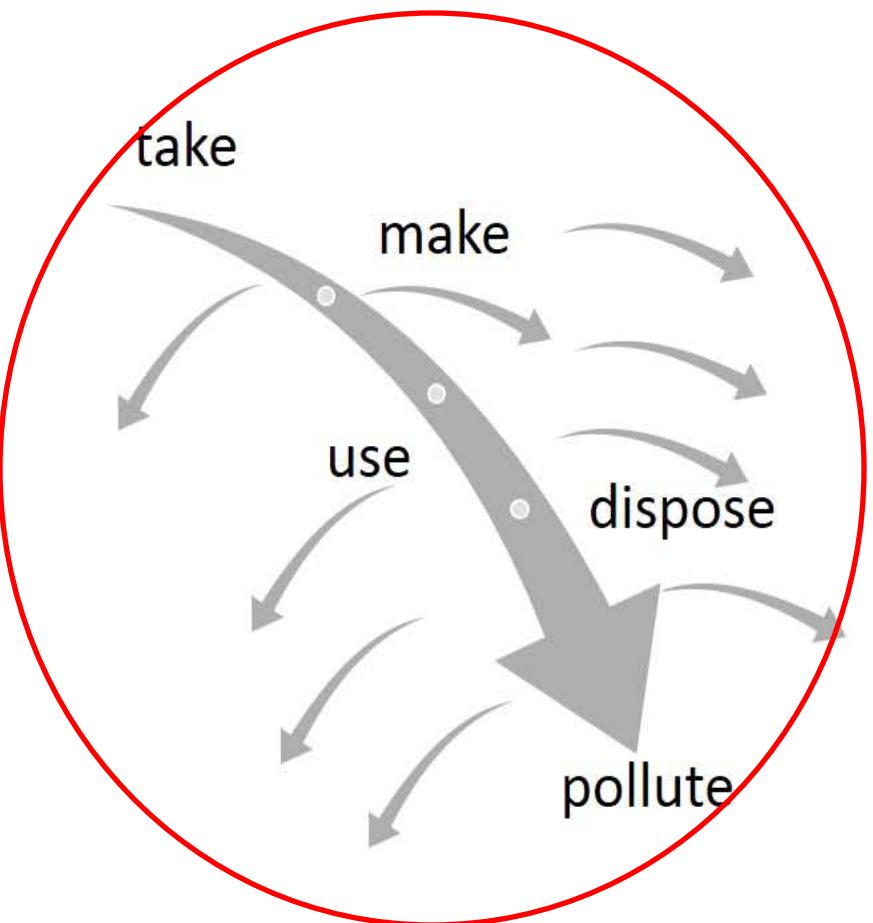


समृद्धिको मूल आधार

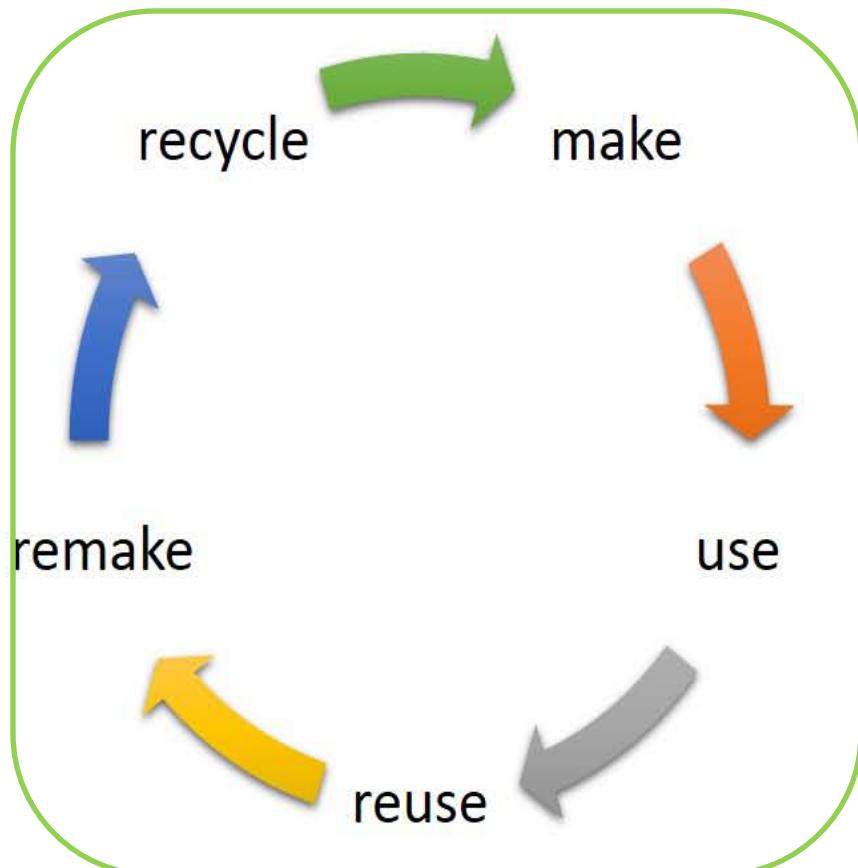


नवप्रवर्तन बिना
विकास/समृद्धि
सम्भव छैन

उपयोगबाद vs दिगोविकास



Our Current Practice



Our future goal



Biomass Energy Strategy, 2017

- **7. Objective**

The objectives of strategy are mentioned as follows:

- 7.1. To contribute to energy supply and energy security by generating energy through management of agriculture forest residues and organic wastes from municipal, urban and industrial areas.

- **8. Strategy**

To achieve above mentioned objectives, the following strategic measures will be adopted:

- 8.1. To increase production of sustainable biomass energy by utilizing agriculture, forest residues and organic wastes.



नास्टले बायोमास सम्बन्धि गरेका प्रयासहरु

NEPAL ACADEMY OF SCIENCE AND TECHNOLOGY

FACULTY OF TECHNOLOGY

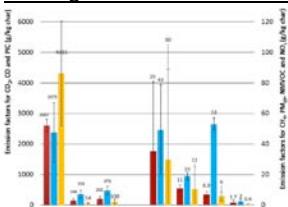
BIOENERGY LABORATORY

BIOMASS LABORATORY

- Biobriquette and Biochar
- Improved Cooking Stoves
- Waste to energy/ management of Invasive plants



Charring different kinds of Biomasses to convert into biochar and biobriquettes

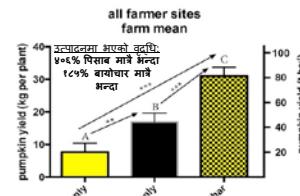


Test result of effluents while charring biomasses

बायोचार भनेको के हो ?
 जैविक पदार्थलाई पोलेर बनाइएको अंगारजन्य बस्तुलाई बायोचार भनिन्छ। बायोचारलाई मातो सुधार गर्न हुतुले बारीमात्रा राख्ने गरिन्दूँ, यसो गर्दा बायुमन्डलमा उत्सर्जित हुने हरितगृह ग्राहको उत्सर्जनलाई कम गर्न सकिन्दूँ, यसले कार्बनलाई जमित मुनि थन्क्याउने विधिमा समेत सहयोग पुर्याउँद्दूँ यी सबै विधिले बायुमन्डलमा हुने कार्बन भार घटाउन दुलो सहयोग पुर्याउँद्दूँ।



Mixing the biochar with Urine for nitrification of Biochar



The production Results of Pumpkin using Biochar and its competitors

BIO-FUEL LABORATORY

- Jatropha, castor and non edible oil
- Waste cooking oil
- fuels from waste plastics
- Blend fuels



Optimization of rocks for trans-esterification

Cost competitive Biodiesel (Target)

Practical Application: Power Generation

Collection of waste cooking oil from a restaurants Transesterification Biodiesel Fuel



Practical application of Biodiesel at Laboratory

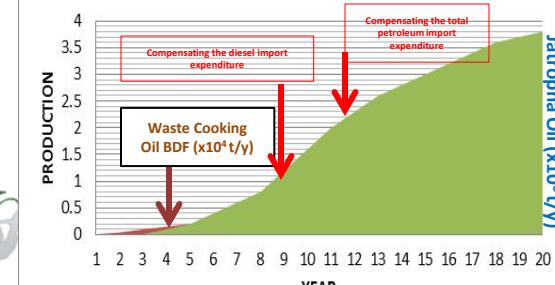
जैविक ऊर्जा (BIO-ENERGY)

जैविक ऊर्जा भन्नाले जैविकश्रोतजन्य नविकरणीय कुनै पनि बस्तु या पदार्थलाई प्रसोधन या रूपान्तर गरी निकालिने ऊर्जालाई जनाउँदछ।

बर्गिकरण

- जैविक ठोस पदार्थमा निश्रीत ऊर्जा (उदाहरण: Bio-briquettes, Biochar)
- जैविक पदार्थबाट निस्कने इन्धनजन्य ऊर्जा (Biofuel: Biodiesel and Ethanol)
- जैविक पदार्थबाट निस्कने ग्रास ऊर्जा (Biogas and Gasifier)
- सुधारिएको चुलो (ICS)

Road Map to Oil-Exporting Country



Potential of biodiesel production in the country

Contact: Dr. Rabindra Prasad Dhakal, Incharge of Laboratory and Faculty Chief. Email: Rabindra.dhakal@nast.gov.np Tel: 977-1-5550813



जैविक ऊर्जा (Bio-Energy)

यसले विभिन्न अबस्थामा रहेका जैविक पदार्थबाट अन्य उपयोगी ऊर्जामा रूपान्तरीत भई प्राप्त हुने ऊर्जालाई जनाउँछ। ।

- जैविक ठोस पदार्थबाट निश्रीत ऊर्जा (Bio-briquettes)
- जैविक पदार्थबाट निस्कने तेलीय ऊर्जा (Biofuel)
- जैविक पदार्थबाट निस्कने ग्यास ऊर्जा (Biogas)
- सुधारिएको चुलो





बायोचार = Bio+char

biochar's triple bottom line

PEOPLE

Human Rights & Health

- Food Security
- Improved Fruit Quality

Affordability/Social Equity

- Reduced Reliance on Fertilizers & Fossil Fuels for Farmers

PLANET

Natural Systems

- Eco-system Restoration
- Storm Water Treatment
- Remediation
- Waste Optimization

Climate Change

- Carbon Sequestration
- NOX Reduction
- Renewable Energy
- Waste to Energy

PROFIT

Economic Development

- Green Jobs
- Clean Technology
- Sustainable Growth Industry





Unused Resources

Ever expanding Invasive plants

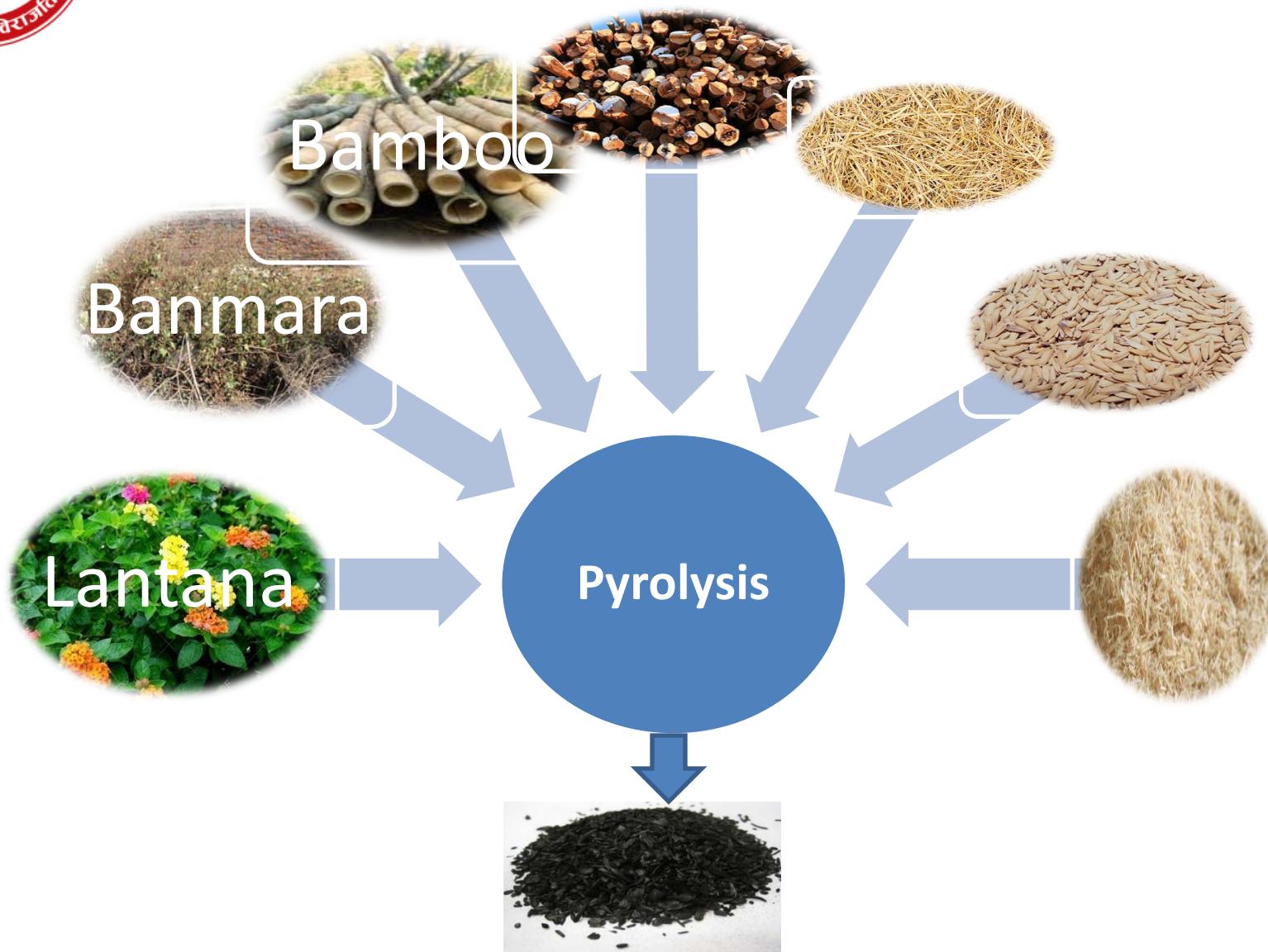


Weedy biomasses





कच्चा पदार्थहरु



Source: <https://carbonationmachine.net/biomass-pyrolysis-plant-sale/>



२. Benefit of Biochar (बायोचारको फाइदा)

• वायुमंडलीय: CO₂ उत्सर्जनमा कमि

विश्वको १०% खेतियोग्य जमिनमा Biochar राखियो भने २९ अर्ब
टन बराबरको CO₂* उत्सर्जन कम गर्दछ

• कार्बनलाई समातेर राख्ने, माटोको N₂O र methane (the main source of methane is from livestock) उत्सर्जन कम गर्ने,
फोहोरबाट निस्कने CO₂ मात्रा कम गर्दछ)

• (माटो/कृषि): माटोको उर्वरता बढाउने; खडेरी वा बाढी सामना
गर्न सक्ने; माटोमा कार्बनको मात्रमा वृद्धि; यसले माटोमा हुने
भारी धातु र अन्य प्रदूषकहरूलाई पनि हटाउँछ

- समुदाय, उद्योग र वनको जैविक पदार्थको प्रयोग;
- मलको अभाव कम गर्न

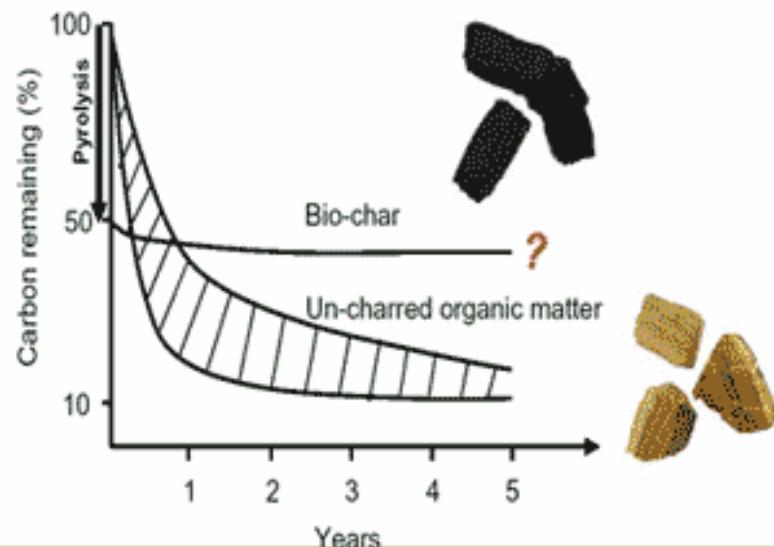
* Johannes Lehmann, a professor of agricultural science at Cornell University .



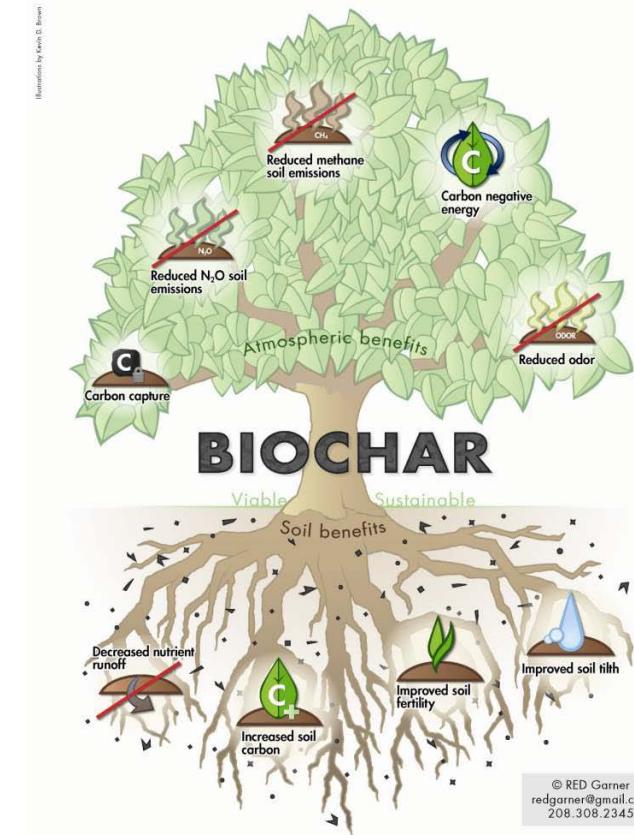
बायोचार भनेको के हो ?

जैविक पदार्थलाई पोलेर बनाइएको अंगारजन्य बस्तुलाई बायोचार भनिन्छ. बायोचारलाई माटो सुधार गर्ने हेतुले बारीमा राख्ने गरिन्छ. यसो गर्दा बायुमन्डलमा उत्सर्जित हुने हरितगृह ग्याँसको उत्सर्जनलाई कम गर्न सकिन्छ. यसले कार्बनलाई जमिन मुनि थन्क्याउने विधिमा समेत सहयोग पुर्याउँछ. यी सबै बिधिले बायुमन्डलमा हुने कार्बन भार घटाउन ठुलो सहयोग पुर्याउँछ.

The essential stability of bio-char

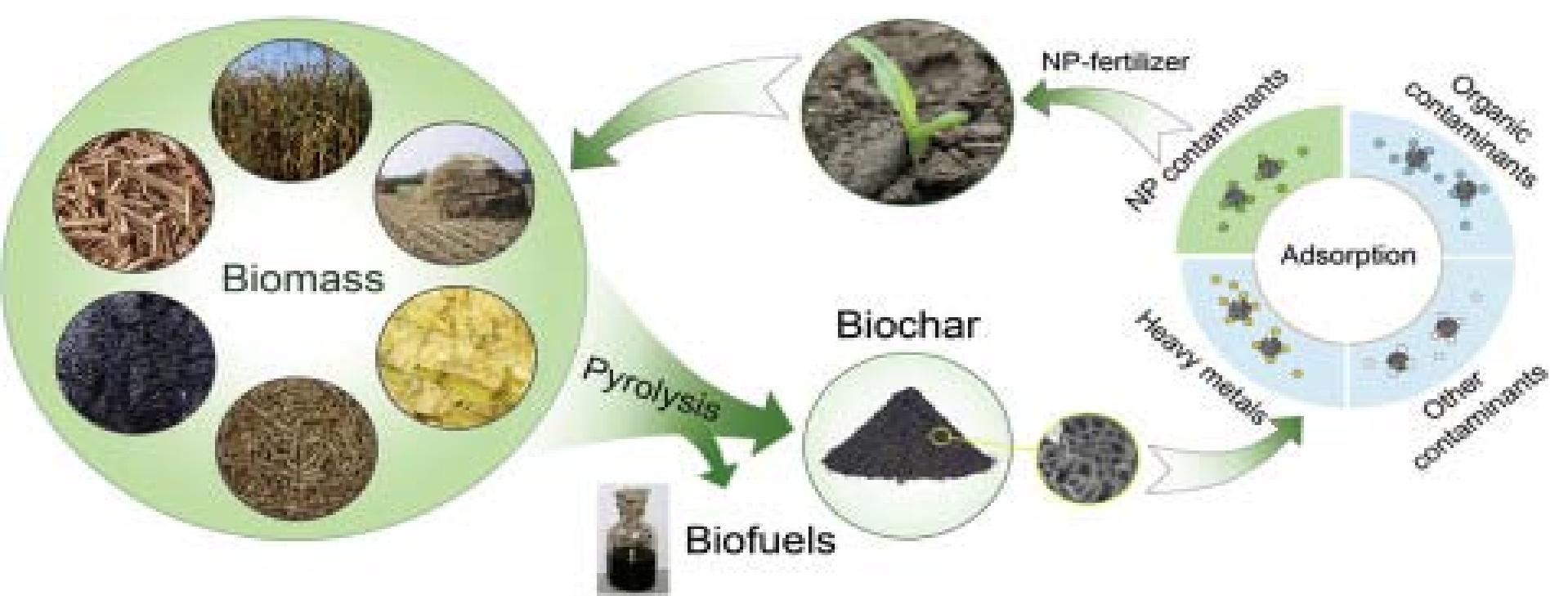


Lehmann et al., 2006, Mitigation and Adaptation Strategies for Global Change 11, 403-427





Biochar Perspective





गुणस्तर परिक्षणका लागी भौतिक पूर्वाधार



Flash point Tester

- To test the flash point
of various fuels



HPLC

-To separate the liquid
from the mixture
-To analyze the
constituents



FT-IR

-To culture the microbes
-To provide thermostat
condition for temperature
sensitive procedure



XRD

-To analyze the crystalline/ amorphous state
of the materials



Biofuel Research Lab



Muffle furnace

- To determine fixed
carbon, moisture
content and VOC



Bomb Calorimeter

for calorific value determination of
fuel and food.



Elemental Analyzer

-To analyze the C,H,N,S of any fuels,
biopolymers, and organic content
--To determine the food value of the
foods



Viscometer

To determine the viscosity of
the BDF and other liquid



Gas emission analyzer

To measure CO, CO₂,
Hydrocarbons, NOx
Temperature and air
fuel ratio

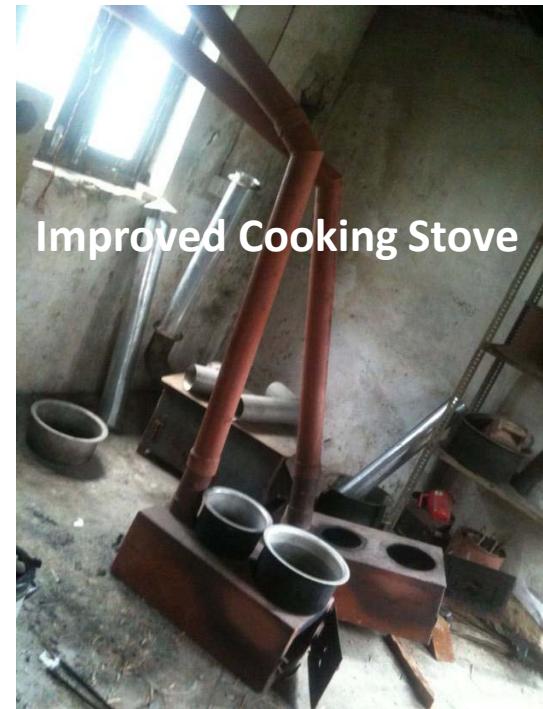


नाष्टमा भएका प्रयासहरु : फरक फरक प्रकृतिका भट्टीहरु





जैविक पदार्थ प्रयोशाला



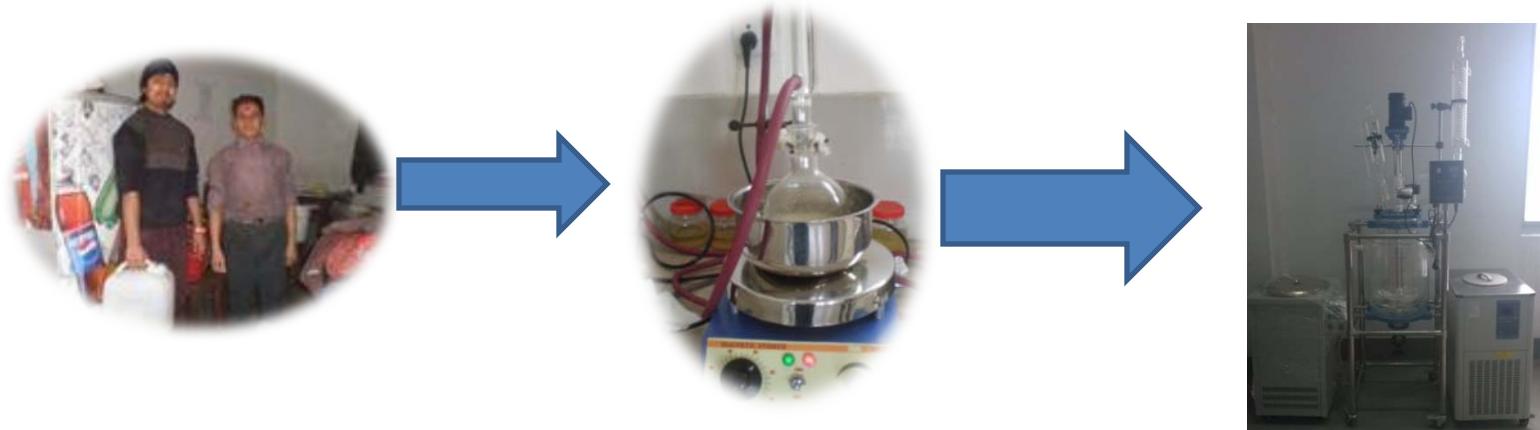


Bio-briquetting





Scaling up of the Technology



Waste cooking oils and
Non-edible oils

Lab scale Biodiesel reactor
1 L Capacity

Biodiesel Reactor Prototype;
100 L/Day



Lab

Field

Trial



बायोचार बनाउने परम्परागत चलन

जमिनमुनि खडलमा परम्परागत विधिबाट बायोचार बनाउंदै नेपाली महिला



Kindly supplied by Prof. Joseph and Ms. Shanny Cambell



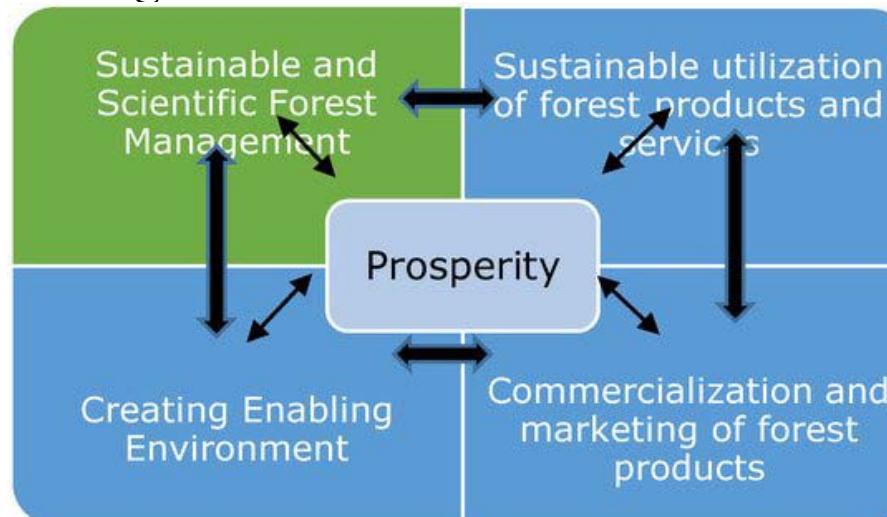
बायोचार उत्पादनको सामान्य विधि





Sustainable Forest Management

- प्रत्येक सदस्यले पर्यावरणमा पुर्याएको क्षतिको निरुपण
- प्रत्येक सदस्यले गरेको श्रमको उचित मुल्यको व्यवस्था
- निर्विकल्प संरक्षणमुखी व्यवस्थापन भन्दा उपभोग उन्मुख वन संरक्षण
- दिगो बिकास केन्द्रित वन र कृषि जोड्ने सामुदायिक प्रयास





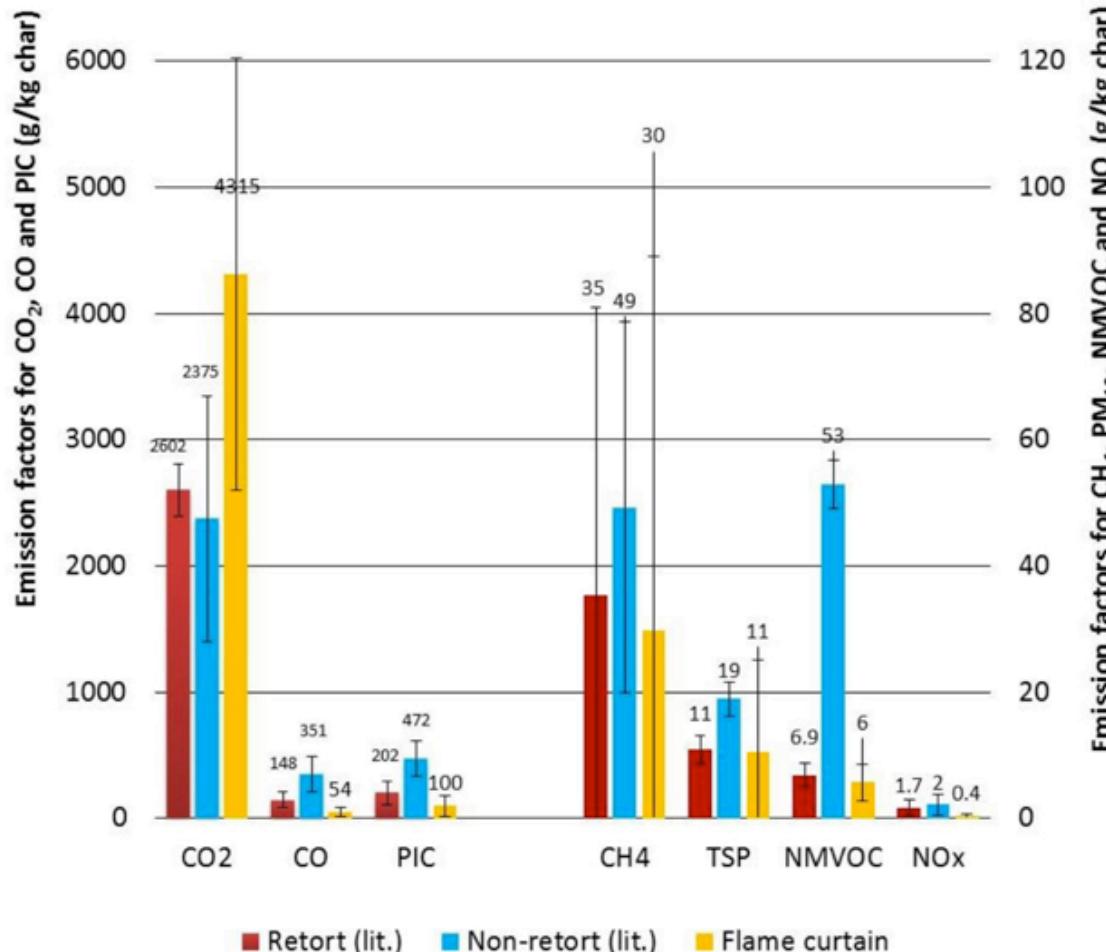
Biochar Production in industrial scale





Emission comparison

Even with difficult feedstocks like wet eupatorium shrubs or rice husks the emission are far lower than any other known low tech pyrolyses



PIC
products of incomplete combustion

TSP: total suspended particulate





४. नेपालमा बायोचारको प्रयोग तथा अध्ययन



बायोचारको नेपालको खेतीमा प्रयोग

गोलभेडा, आलु, प्याज, जौ, मके, रामतोरिया, धान, बोडी, केरा, कफी, चिया, तेजपत्ता, फसी, खुसर्नी, बन्दा



Research and application



Urine enhanced Biochar



Designing plot for maize cultivation



Maize at the time of maturity



Elemental Analyzer (Euro EA)

Some glimpses of its activities on Biochar!



समुदायसंग
काम,
प्राबिधिक
प्रशिक्षण
एवम तालीम



काम -कम्युनिटीसंग, विज्ञान- उत्पादन र निर्माणसंग प्रबिधि- विकास र समृद्धिसंग



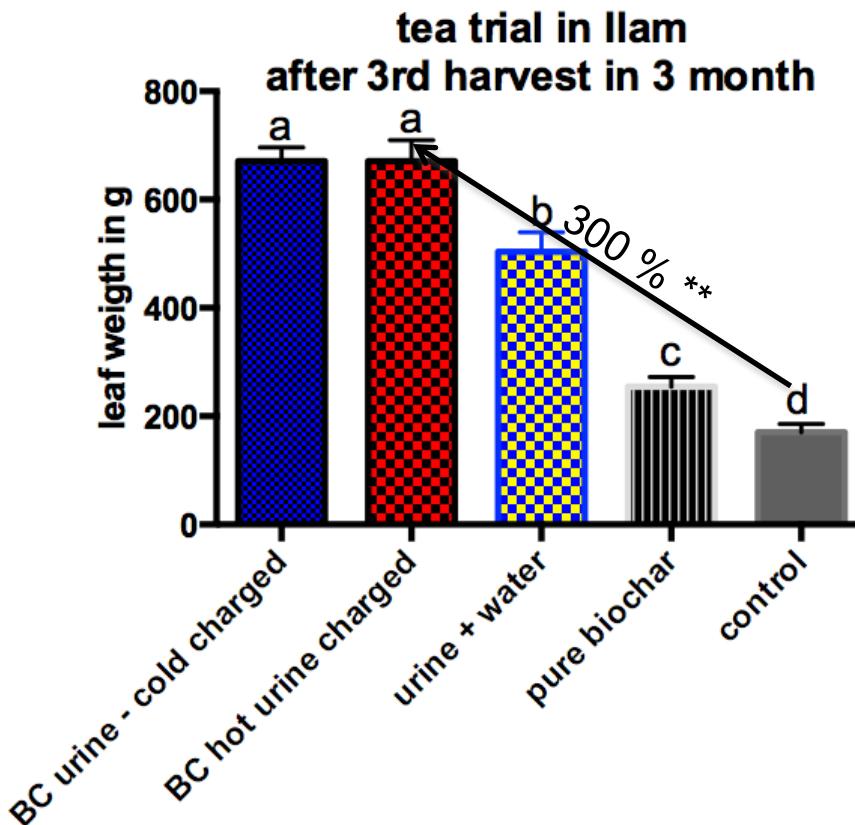


रासायनिक मल
जस्तै काम गर्ने
मलको भरिया:
बायोचार

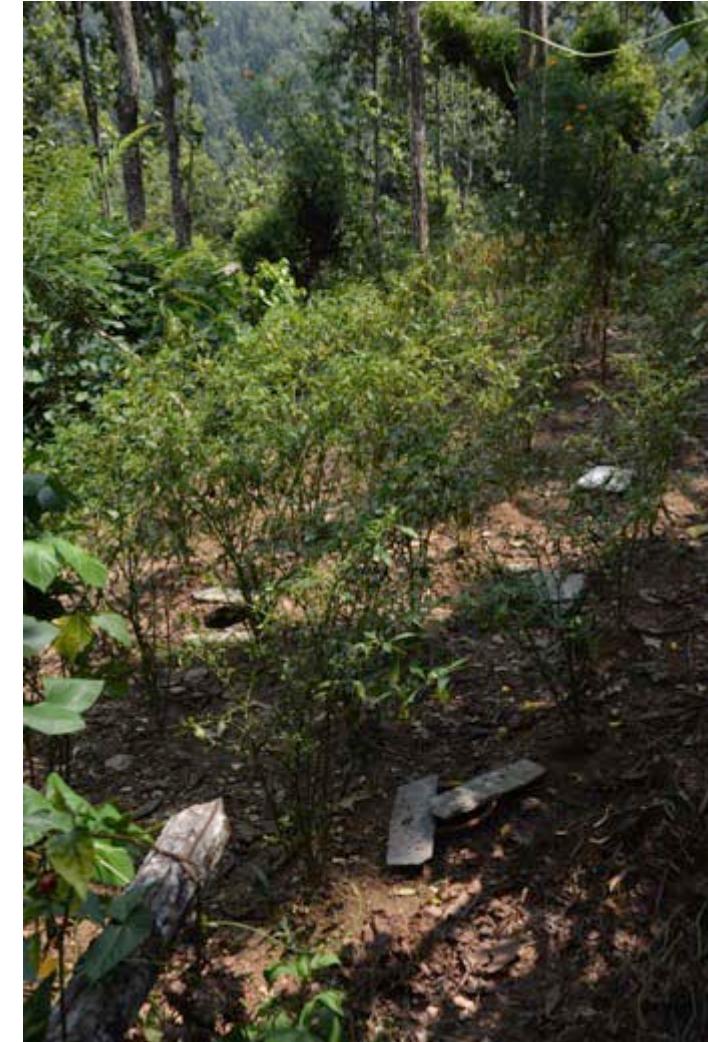
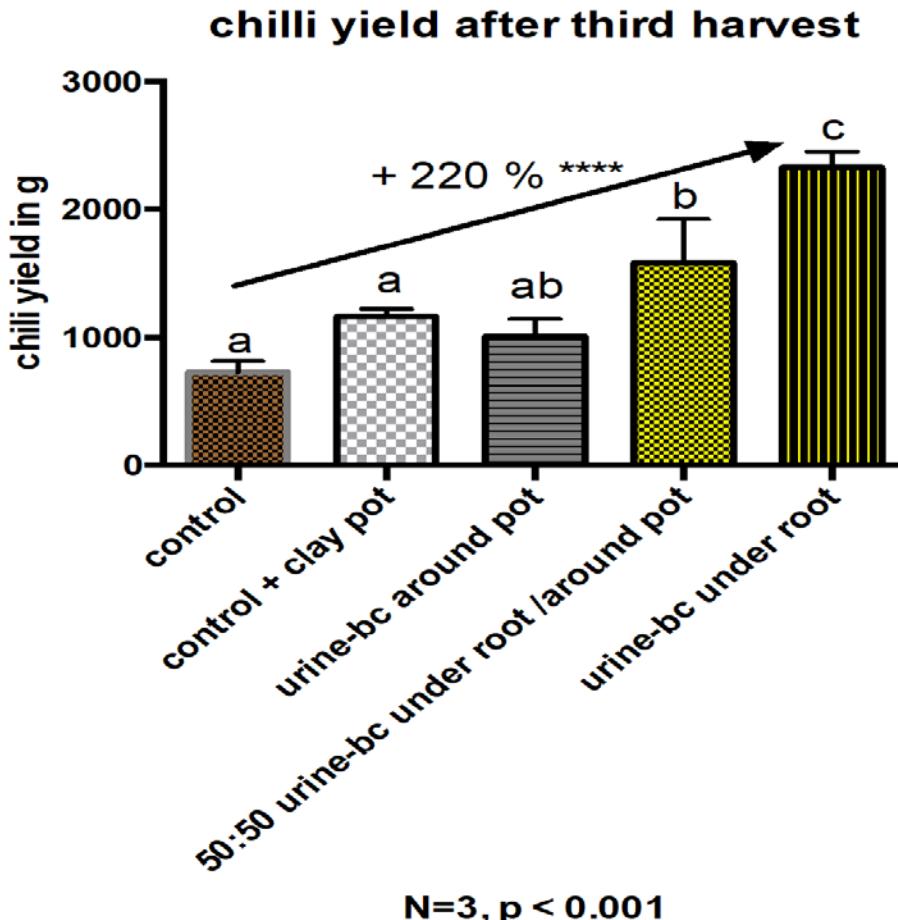
म मरे पनि मेरो बायोचार बनाउनु भन्ने “कमाउंदै पढ्दै” गरेका विद्यार्थी बायोचार र
अकार्निक कृषिमा काम गर्दै



इलामको चियामा गरिएको प्रयोग

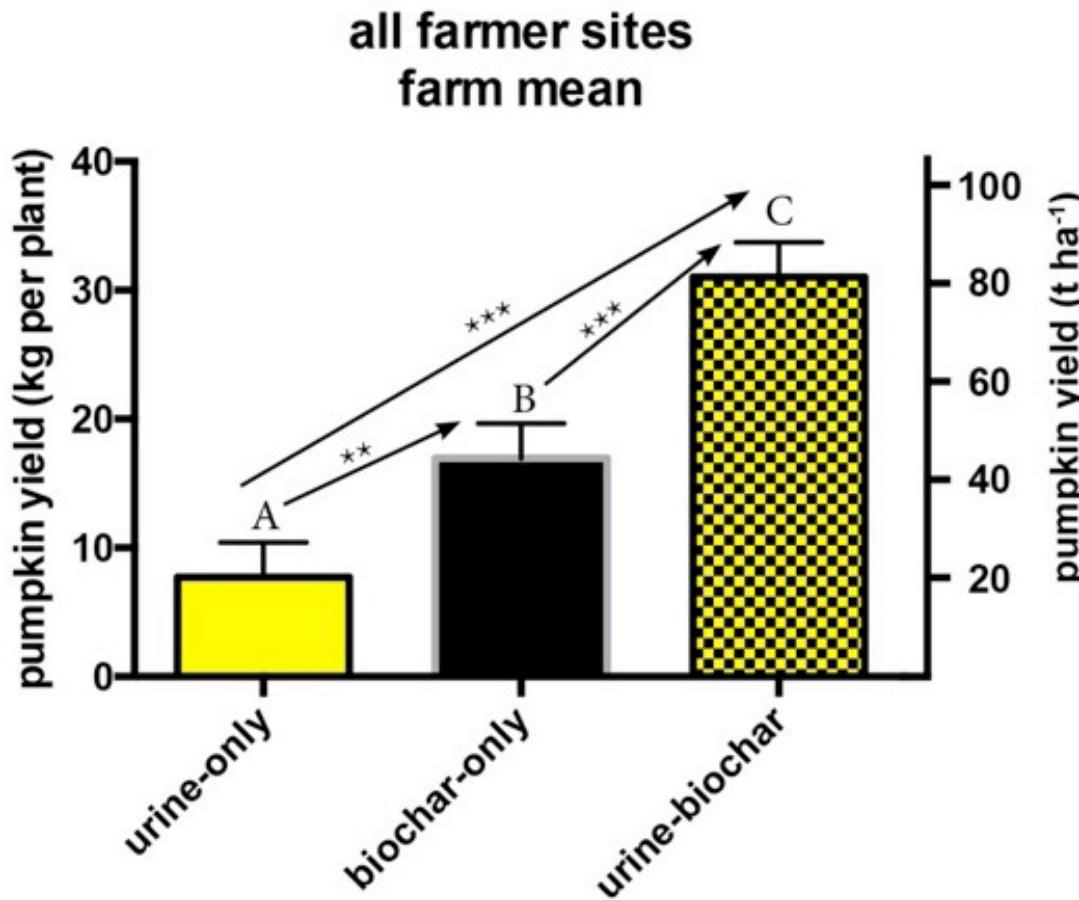


बन्दिपुरको खुसानी खेती



फसी उत्पादनको को उल्लेख्य वृद्धि

Pumpkin yield with urine enriched biochar



७५० किलो बायोचार/हे
८ मी३ पिसाब/ हे

$p < 0,0001$

उत्पादनमा भएको वृद्धि:

४०६% पिसाब मात्रै भन्दा
१८७% बायोचार मात्रै भन्दा



Way Forward

- Natural Resource assessment, Problem Identification, Technology development or acquisition, Technology adoption are Technology dissemination could be 5 pillars of sustainable developments.
- Subsistence farming system has to be replaced by modern practices using Science and Technology to lure the youth in Agriculture.
- Sustainable development through Energy generation, soil amendment, environment protection, productivity enhancement and employment generation can be done by innovative ideas
- Collaborative research, invest intensive, market oriented farming, modernization of farm approaches can bring the youth in the field.



धन्यबाद

आर्थिक सहयोग र सहकार्य

- ADB project – नार्क, कृषि बिकास मन्त्रालय,
- Darwin Initiative- Royal Botanical Garden UK, Forest Action Nepal
- नीति तथा योजना आयोग, गण्डकी प्रदेश

भौतिक सहयोग

- बन उपभोक्ता समुहहरु एवम् उपभोक्ताहरु

- बायोइंजिनिअरी प्रयोगशालाका अनुसन्धानकर्ता एवम् सम्पूर्ण नाष्ट परिबार र
- नेपाल सरकार