

GREEN CREW

Activities performed by the Municipality of Blagoevgrad under the project Green_Crew

Project Title: "Green" Employment in the Management of Biowastes"",
Green_Crew

PB4: Municipality of Blagoevgrad



ARISTOTLE
UNIVERSITY
OF THESSALONIKI



Municipality of Plovdiv



The project is co-funded by the European Regional Development Fund and by national funds of the countries participating in the Interreg V-A "Greece - Bulgaria 2014 -2020" Cooperation Programme

MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Approved budget of Municipality of Blagoevgrad (PB4) - 129 424.40 EUR

Main activities to be implemented under the project yet:

- Organization of one/final conference on the promotions of the project results for 30 participants. The event will be held on 30.09.2020.



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Approved budget of Municipality of Blagoevgrad (PB4) - 129 424.40 EUR

Main activities already implemented under the project:

- Organization of a Project Team Meeting
- Organization of a “white-shared” training week
- Supply of a smart education equipment



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Main activities already implemented under the project:

- Preparation of Evaluation and Efficiency assessment report for the SCE
- Development of Guidelines
- Development and delivery of the social impact evaluation study
- Organization of a public awareness campaign on the SCE concept, as well as biowaste composting
- Ensuring information and publicity measures



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 1 „Management and Coordination“:

- Participation in the Kick-off meeting, organized by Municipality of Serres
- Organized internal project team meetings in Blagoevgrad
- Prepared Request for Modification for a change in the type of a tender procedure;
- Prepared and sent to LB 6 (six) PPRs
- Organized and conducted the 2nd Project team meeting in Blagoevgrad, Bulgaria
- Keeping correspondence with PBs and JS



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Municipality of Serres



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 2 „Information and Publicity“:

- Provided measures for information and publicity through the production of 3 banners, 50 posters, 200 brochures, 200 folders for the social results of the management of "green waste", 6 publications.



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 3 „Exploring the social contribution of bio-waste“:

- Organized of a „white-shared“ training week for approximately 60 participants. The event was conducted 22-26 october 2018.
- Supplied smart education equipment (smart board, PC equipment, software), 1 (one) PC.



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Municipality of Nesebar



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 4 „Recycling of organic waste“:

Prepared of a evaluation and efficiency assessment report for the Social cooperative enterprise (SCE) enrolment in the utilization of the "green wastes"



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Municipality of Nesebar



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 5 „Evaluation & framework development“:

Prepared

“Development of guidelines on maximizing the environmental and socioeconomic benefits of social cooperative enterprising network.”

and

“Development and delivery of the social impact evaluation study”



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MUNICIPALITY OF BLAGOEVGRAD (PB4) AND PROJECT GREEN_CREW

Progress of the implementation of the activities

WP 5 „ Evaluation & framework development“:

Organized and conducted of a public awarness camgpain in Blagoevgrad on the SCE concept as well as biowaste composting. The event was held 11-13.03.2020 in Blagoevgrad, Bulgaria.



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Interreg
Greece-Bulgaria
European Regional Development Fund



**MUNICIPALITY OF BLAGOEVGRAD (PB4) AND
PROJECT GREEN_CREW**

THANK YOU FOR THE ATTENTION!

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GREEN CREW

“Green” Employment in the Management of Biowastes

“Physical-chemical characteristics of waste lignocellulosic biomass and produced compost”

Prof. Konstantinos S. Triantafyllidis

Department of Chemistry, Aristotle University of Thessaloniki

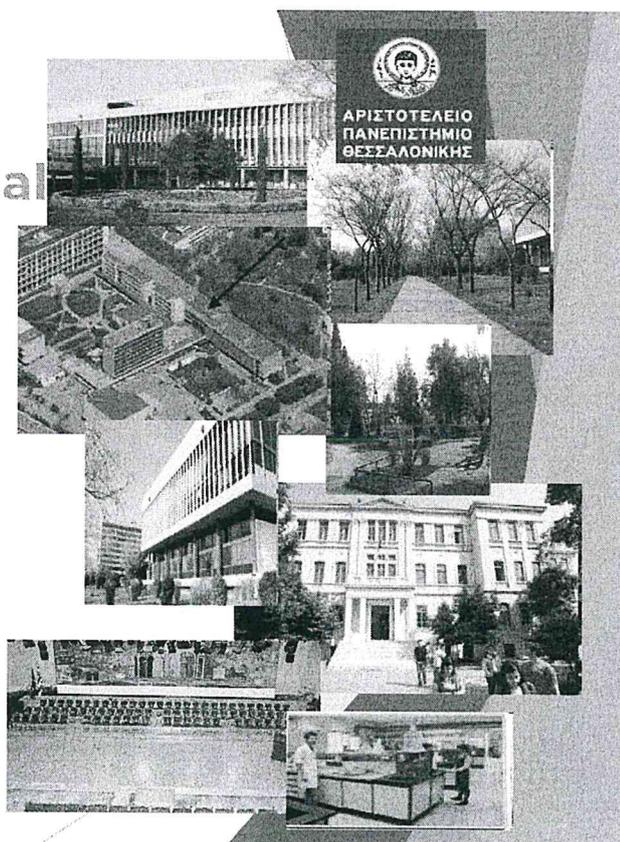


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Aristotle University of Thessal

- The Aristotle University of Thessaloniki is the largest University in Greece
- It consists of 7 Schools with more than 80.000 students and over 2.000 educational and research personnel
- The **Department of Chemistry (P2)** being part of the Faculty of Sciences, supports undergraduate, masters and PhD educational programs and conducts basic and applied research in all dominant fields of chemistry and chemical technology



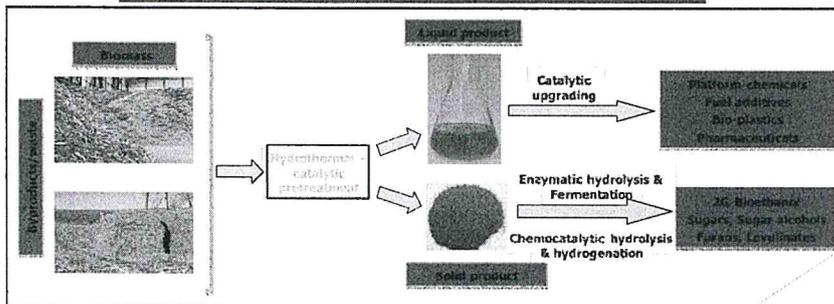


Research & training on biomass valorization to fuels, chemicals, materials

The Laboratory of Chemical and Environmental Technology

(<http://ktrianta.webpages.auth.gr/>), at the Department of Chemistry, AUTH:

- ❖ conducts basic and applied research in **biomass valorization** and **biorefining** towards the production of bio-chemical, bio-fuels, bio-polymers
- ❖ Offers courses and training programs in biorefining and related areas



Role of AUTH in the project

- S.W.O.T analysis report stating the high level of situation awareness in all critical issues concerning the existing potential on bio-waste manipulation (WP3, D3.1)
- Social economy networking report and development of the social cooperation enterprise manual (WP3, D3.2)
- Social impact evaluation study (WP5, D5.2)
- Development analytical methodology for the determination of physicochemical characteristics of biomass raw material and the produced compost (WP4, D4.2)
- Education services, in composting methodologies and waste biomass management
- Support Municipalities of Serres and Nestos in optimization of compost systems



“Physical-chemical characteristics of waste lignocellulosic biomass and produced compost”

- Agricultural and urban biomass wastes-residues, agro-food industry wastes, food wastes
- Lignocellulosic biomass
- Composting process
- Determination of physical and chemical properties of biomass and compost samples



Agricultural and agro-food industry wastes



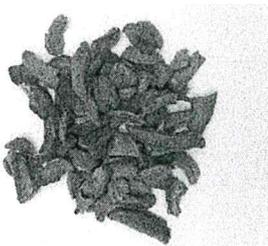
Olive tree prunings
Olea europaea L. cv.
Chondroelia Chalikidikis



Vineyard prunings
Vitis vinifera cv. Xinomavro



Bitter orange tree prunings
Citrus × aurantium cv. Seville



Almond shells
Prunus amygdalus cv.
Texas



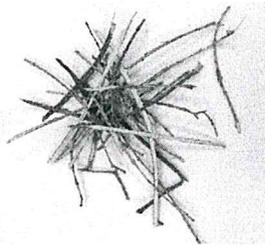
Apricot kernels
Prunus
armeniaca



Wheat stems
Triticum aestivum



Selected biomass and compost samples *Olea europaea* [Olive tree prunings]



branches



leaves



branches & leaves



compost
early stage (3 months)



compost
mid stage (6 months)



Compost
12 months - chopped



Biomass & Compost samples from Nastos

Initial samples (January 2020)



- Olive tree (ελιά)
- Plane tree (πλατάνι)
- Cypress (conifers) (κυπαρίσσι, κωνοφόρα)

Early stage compost samples (2 months old, March 2020)



Compost samples (9 months old, September 2020)





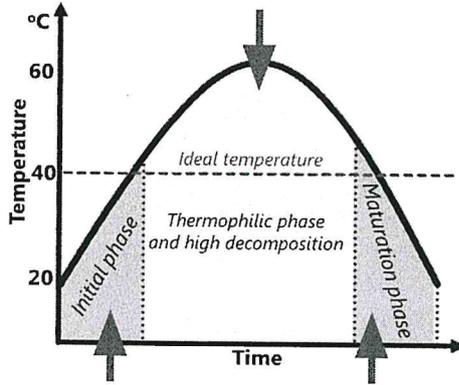
Composting

Composting is the biological decomposition of organic matter or biomass that occurs under aerobic conditions (presence of O_2), with adequate moisture and temperature. It can be considered as the sum of complex metabolic and biochemical processes performed by microorganisms (bacteria, fungi, actinomycetes) using available nitrogen (N) and carbon (C) for their growth. Products: **compost, CO_2 , water, organic acids, humus and heat**

- Thermophile stage (40-60°C) with bacteria, fungi, actinomycetes, (enhanced degradation of (hemi)cellulose, proteins and fats)
- pH increase due to degradation of proteins and ammonia release.



Low value biomass waste



Compost

- Value added product $\approx 80\text{€}/\text{m}^3$
- Soil conditioner, fertilizer, pesticide

- Mesophile stage (<40°C), mild acid/enzymatic hydrolysis
- Decrease of pH due to the organic acids released from the carbohydrates and lipids
- Mesophile stage with bacteria and fungi (slow lignin degradation)
- Polymerization/condensation reactions occur toward humus/humic acids formation

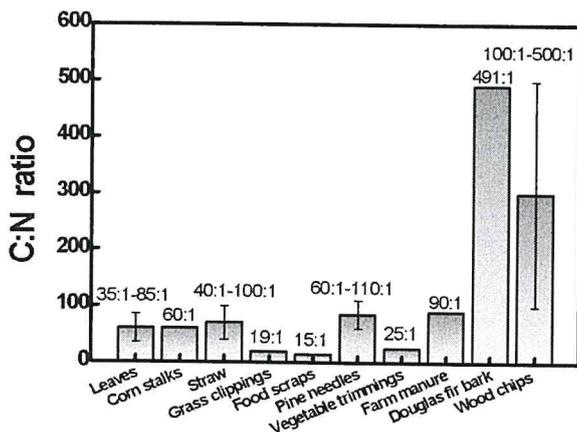
Azim et al. Org. Agr. 2016, DOI 10.1007/s13165-017-0180-z



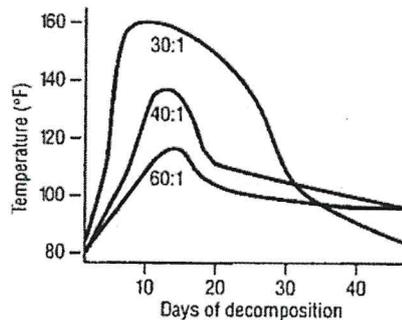
Factors affecting composting process

Effect of C/N ratio

- Organisms that decompose organic matter use carbon as a source of energy and nitrogen for building cell structure. They need more carbon than nitrogen. If there is too much carbon (high C/N), decomposition slows down when the nitrogen is used up and some organisms die. At lower C/N ratios, nitrogen will be supplied in excess and will be lost as ammonia gas, causing undesirable odors. *Recommended C/N ratio: 30/1*



Carbon:Nitrogen Ratio Effects on Composting



Understanding the Composting Process, University of Arkansas, United States Department of Agriculture, and County Governments Cooperating
<http://cwmi.css.cornell.edu/composting.htm>
<http://whatcom.wsu.edu/ag/compost/fundamentals/index.htm>



Factors affecting composting process

Effect of temperature

- Temperatures 40-60 °C indicate rapid composting while higher temperatures reduce the activity of most organisms. Under optimum conditions and with frequent turning, usable compost might be produced in one month. Prolonged high temperatures are avoided because nitrogen loss is greater (ammonia vaporization), at low C:N.

Effect of moisture

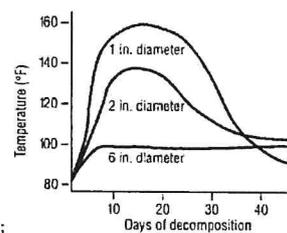
- High moisture content must be avoided because water displaces air from the interstices between the particles causing anaerobic conditions. However, too low moisture content deprives organisms of water needed for their metabolism, and inhibits their activity. *Recommended moisture content: 40-80%*

Effect of particle size

- Smaller particles allow the microorganisms to digest more material, multiply faster and generate more heat. Chopping, shredding or chipping materials accelerates the composting process. *Recommended size: 1 - 3 cm.*

Understanding the Composting Process, University of Arkansas, United States Department of Agriculture, and County Governments Cooperating; <http://cwmi.css.cornell.edu/composting.htm>; <http://whatcom.wsu.edu/ag/compost/fundamentals/index.htm>

Particle Size Effects on Composting



Factors affecting composting process

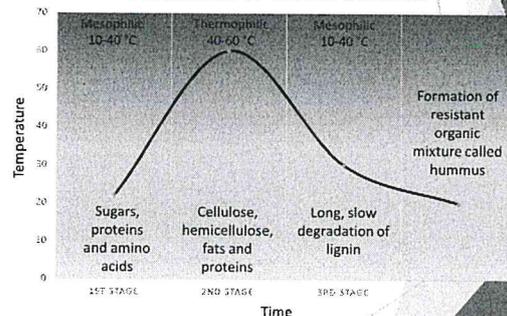
Effect of pH

- As bacteria and fungi digest organic matter, they release organic acids. In the early stages of composting, these acids often accumulate. Increased pH at latter stages encourages the growth of fungi and the breakdown of lignin and cellulose. *Recommended pH: 5.5-8.5*

Effect of lignin

- High lignin content in plant composition, decrease degradation rate and the decomposition is favored only in presence of enzymes from specific fungi.
- Lignin structure affects degradation.
- In order to overcome such problems, addition of small quantities of nitrogen to woody materials can increase lignin degradation rates. Furthermore, biodegradability can be enhanced by pretreatment of lignocellulosic materials.

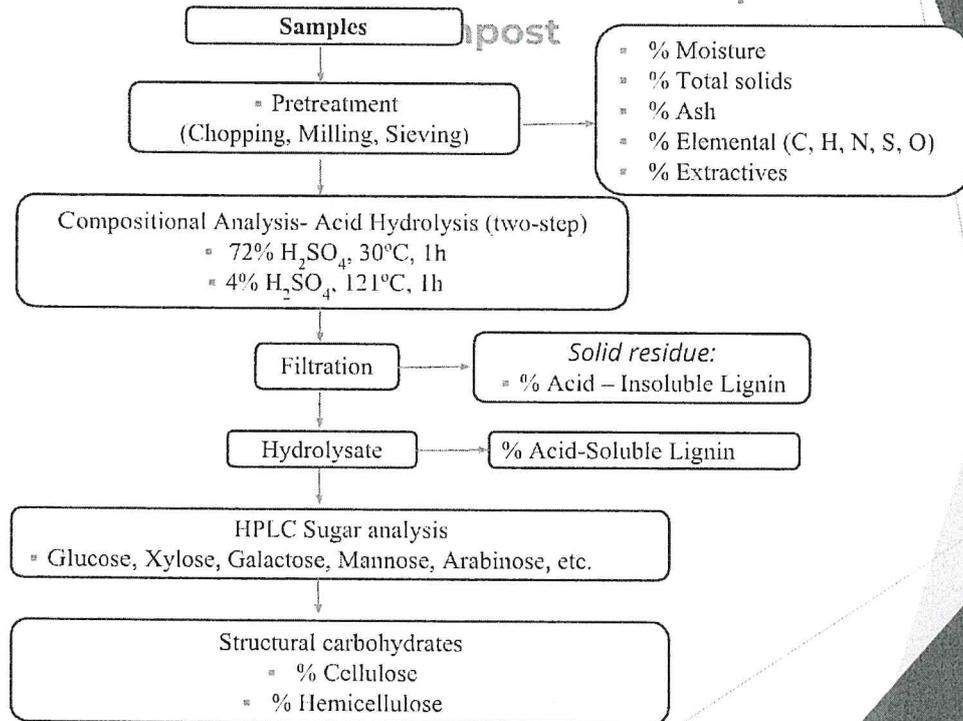
DEGRADATION OF ORGANIC MATERIALS



Understanding the Composting Process, University of Arkansas, United States Department of Agriculture, and County Governments Cooperating
<http://cwmi.css.cornell.edu/composting.htm>
<http://whatcom.wsu.edu/ag/compost/fundamentals/index.htm>



Protocol for physicochemical characterization of biomass samples & post



Moisture, ash, volatile solids and elemental analysis (dry basis (wt.%) of selected agricultural bio-wastes

| Biomass feedstock | % Moisture | % Ash | % Volatile solids | N% | C% | H% | S% | O% | C/N |
|---------------------------------------|------------|-------|-------------------|-----|------|-----|-----|------|------------|
| Olive tree prunings and leafs | 7.8 | 3.5 | 96.5 | 0.9 | 49.1 | 6.6 | 0.1 | 43.3 | 52 |
| Vineyard prunings | 9.7 | 3.2 | 96.8 | 0.5 | 44.9 | 7.9 | - | 46.7 | 88 |
| Poplar prunings | 6.9 | 6.8 | 93.2 | 1.5 | 48.2 | 6.2 | 0.1 | 44.1 | 32 |
| Bitter orange tree prunings and leafs | 8.2 | 9.3 | 90.7 | 1.3 | 46.2 | 5.6 | 0.1 | 46.8 | 36 |
| Wheat stems | 9.7 | 4.6 | 95.4 | 0.5 | 43.1 | 7.4 | - | 49.0 | 91 |
| Almond shells | 9.8 | 1.6 | 98.4 | 1.4 | 54.1 | 6.6 | 0.1 | 43.3 | 52 |
| Apricot kernels | 5.4 | 0.4 | 99.6 | 0.3 | 49.7 | 8.0 | - | 42.0 | 159 |

- Moisture was determined after air-drying at room temperature and knife-milling
- ** Ash: inorganics, i.e. Si, Al, Ca, Mg, K, Na, P, etc.



Composition analysis of selected biomass feedstock (wt.%, dry basis)

| Biomass feedstock | % Extractives | AI L | ASL | Total Lignin | Glu | Xyl | Gal | Ara | Man | Total Sugars | Mass balance |
|--|---------------|------|-----|--------------|------|------|------|-----|-----|--------------|--------------|
| Olive tree prunings | 21.6 | 39.3 | 4.9 | 44.2 | 13.1 | 4.3 | 2.8 | - | 3.3 | 23.5 | 93 |
| Vineyard prunings | 17.8 | 19.1 | 2.0 | 21.1 | 32.6 | 8.1 | 2.7 | 2.1 | - | 45.5 | 88 |
| Poplar prunings | 18.9 | 18.0 | 1.0 | 19.0 | 40.5 | 14.1 | 0.9 | 1.5 | 3.8 | 60.8 | 99 |
| Bitter orange tree prunings and leaves | n.d | 24.8 | 0.1 | 24.9 | 39.5 | 14.5 | - | - | - | 54.1 | 88 |
| Wheat stems | 19.3 | 6.2 | 3.2 | 9.4 | 30.8 | 18.6 | 2.1 | 9.8 | 0.2 | 61.6 | 95 |
| Almond shells | 9.5 | 30.3 | 2.4 | 32.7 | 28.2 | 22.7 | 6.2 | 1.5 | 2.9 | 61.5 | 105 |
| Apricot kernels | 6.2 | 33.8 | 2.7 | 36.5 | 19.2 | 15.8 | 10.9 | 2.1 | 1.4 | 49.4 | 92 |

* In the mass balance, ash content is also added.



Moisture, ash, volatile solids and elemental analysis (dry basis, wt.%) of olive tree pruning and compost products

| Biomass feedstock | % Moisture | % Ash | % Volatile solids | N% | C% | H% | S% | O% | C/N |
|--------------------------------|------------|-------|-------------------|-----|------|-----|-----|------|-----------|
| Olive tree prunings and leaves | 7.8 | 3.5 | 96.5 | 0.9 | 49.1 | 6.6 | 0.1 | 43.3 | 52 |
| Compost 3 months old | 4.7 | 4.3 | 95.7 | 1.3 | 50.4 | 8.5 | - | 39.8 | 39 |
| Compost 6 months old | 6.0 | 10.6 | 89.4 | 1.3 | 46.3 | 7.6 | - | 44.7 | 35 |
| Compost 9 months old | 7.0 | 8.7 | 91.3 | 1.6 | 44.9 | 7.8 | - | 45.7 | 27 |
| Compost 12 months old | 7.2 | 8.9 | 91.1 | 1.5 | 40.1 | 6.9 | - | 51.6 | 27 |

| Biomass feedstock | % Moisture | % Ash | % Volatile solids | C% | H% | N% | O% |
|------------------------|------------|--------|-------------------|------|-----|-----|------|
| Nestos initial samples | 6.2 | 32.2 | 67.8 | 46.7 | 6.1 | tbd | 47.2 |
| Nestos early compost | 8.0 | 45.2** | 54.8 | 46.4 | 6.2 | tbd | 47.4 |
| Serres compost | 9.4 | 11.7 | 88.3 | 31.1 | 3.9 | tbd | 64.9 |

* Moisture was determined after air-drying at room temperature and knife-milling

** Ranged from 10-50 %



Composition analysis of selected biomass samples and compost products (wt % dry basis)

| | Olive tree prunings and leafs | Compost 12 months old | Nestos initial | Nestos early stage compost | Serres compost |
|----------------------|-------------------------------|-----------------------|----------------|----------------------------|----------------|
| % Extractives | 21.6 | 13.9 | 13.8 | 8.6 | 8.3 |
| %AIL | 39.3 | 44.7 | 31.4 | 40.6 | 50.7 |
| %ASL | 4.9 | 5.2 | 2.1 | 2.5 | 1.8 |
| Total Lignin | 44.2 | 49.9 | 33.5 | 43.1 | 52.5 |
| %Glucan | 13.1 | 8.9 | 16.9 | 8.5 | 9.2 |
| %Xylan | 4.3 | 4.3 | 9.3 | 7.9 | 5.2 |
| %Galactan | 2.8 | 2.9 | 2.1 | 2.7 | 1.8 |
| %Arabinan | - | - | - | - | 0.9 |
| % Mannan | 3.3 | 3.2 | 4.6 | 4.6 | 0.2 |
| Total Sugars | 23.5 | 19.3 | 32.9 | 33.8 | 17.3 |
| % Ash | 3.5 | 8.9 | 22.2 | - | 11.7 |
| Mass balance | 93 | 92 | 102 | 101 | 90 |



Conclusion

- Characterization of biomass wastes is useful for the design of efficient composting processes by selecting the appropriate feedstocks (mixtures) and conditions.
- Analysis of biomass and compost samples showed that the carbohydrates are digested faster than lignin – its content remains relatively high in the compost product – **the antioxidant and antimicrobial properties of lignin may be also utilized.**
- Composting of relatively high C/N lignocellulosic waste may offer high quality compost with increased N relative content.
- The content and type of inorganics present in biomass may also increase the nutritional properties of compost.

Acknowledgements

INTERREG V-A
“GREECE - BULGARIA 2014 – 2020”
COOPERATION PROGRAMME

“GreenCrew is co-funded by the European Regional Development Fund and by national funds of the countries participating in the Interreg V-A “Greece-Bulgaria 2014-2020” Cooperation Programme.

- Dr. Georgios Giannopoulos
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- Georgia Papapanagiotou, MSc
- Danae Papadopoulou



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MODERN WASTE MANAGEMENT & OPPORTUNITIES FOR SOCIAL ENTERPRISES (SME's)

Project title:

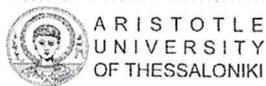
Priority Axis:

Thematic objective:

Investment

Priority:

Specific Objective:

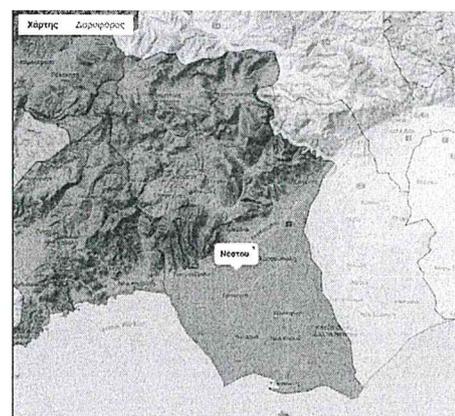


Municipality of Mesta

Crucial target set for the project:

The stimulation of Social Enterprises involvement to Bio-wastes management.

- **First step:** Investigate thoroughly the Waste Management status to the intervention area by elaborating a SWOT analysis



Green-Crew Deliverable 3.2.1. : SWOT Analysis for bio-wastes at Serres & Nestos municipalities

- Brief presentation of the study area and its predominant socio-economic characteristics.
- Analytical presentation of the current and near future local waste management status, especially its organic proportion.
- SWOT analysis for pinpointing the key factors for “greening” the bio-wastes management in the area.
- Definitions of: “green economy”, “green jobs”, “green entrepreneurship”
- Identification of the “green – skills needs”.
- Underpinning of the specific conditions existing to the project area.
- Proposals.

Proposals from SWOT analysis for the areas of Serres & Nestos municipalities

1. Creation of new and improvement & expansion of existing Small Enterprises (including Social Enterprises') active in the management of organic Municipal Solid Wastes in the area
2. Encouragement of collaborative actions among social enterprises and local authorities with the aim of crating and operating of Centers for training on recycling & presorting wastes.
3. Focus for cooperative enterprises to undertake the task of establish and operate small composting units for agro –wastes and pre-sorted urban bio-wastes

Green-Crew Deliverable 3.2.2: Manual for creating Social Enterprise for composting of bio-wastes

1. Explaining the concept of Social Enterprise
2. Basic characteristics of local economy's environment
3. Drafting an example of a Social Enterprise dealing with composting of biowastes
 - Core elements of the S.E.
 - Shareholders & investment capital
 - Production activities of the S.E.
4. Human resources of the S.E.
5. Location site of the S.E.
6. Equipment & machinery needed



(continued)

Green-Crew Deliverable 3.2.2: Manual for creating Social Enterprise for composting of bio-wastes *(continued)*

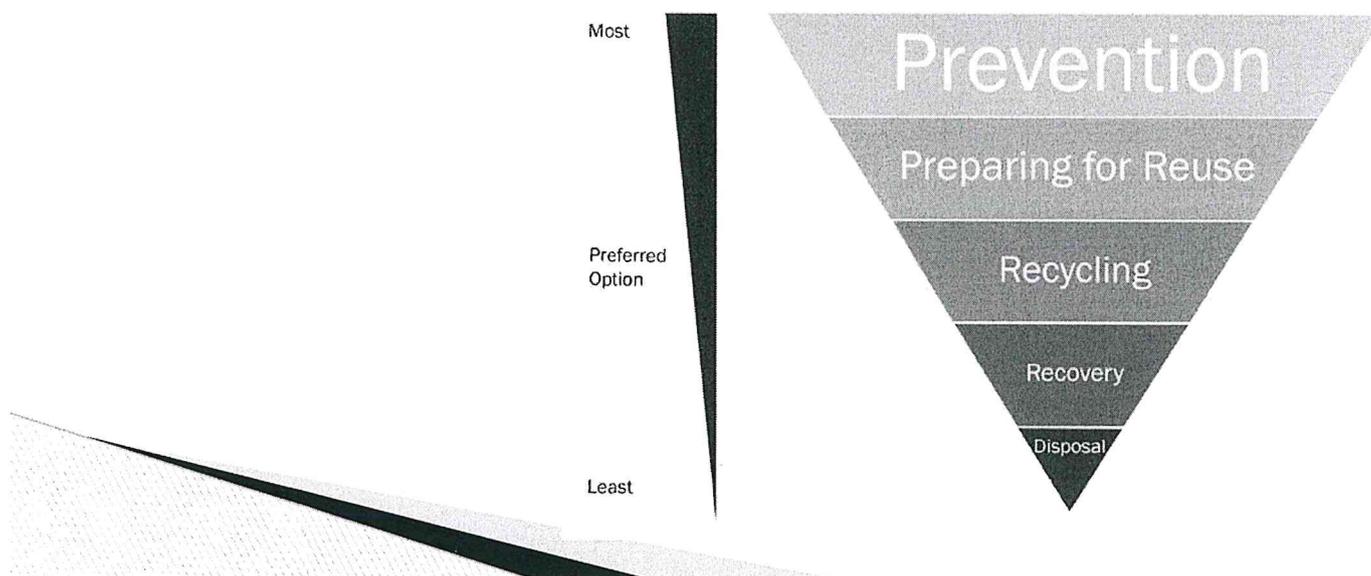
7. Analysis of the general sector of the compost unit
 - Legislation
 - Competition
 - Targeted markets
 - Suppliers – collaborator's
8. Analysis of the specific economic environment in which the compost unit will operate
9. Local market penetration strategy
10. Financial Analysis of Investment Costs
 - Budget and possible funding of the investment
 - Analysis of projected revenues during the first year of operation
 - Analysis of the expenses of the first year



Green-Crew Deliverable 5.2.2: Social impact analysis – 1

1. The Municipal Solid Waste Management & Green Economy.

- Detecting the opportunities for social entrepreneurship and employment of the MSW sector.
- Employment generation as a benefit of “greening” the Solid Waste Sector.
- Skills for the green economy: towards a new concept of education and training.



Green-Crew Deliverable 5.2.2: Social impact analysis – 2



Collectors

Organizations which pick up or transfer materials through curbside, bulky collection and / or commercial onsite collection of recyclable material. Include private, local authority and third sector organization.



Brokers

Businesses that purchase recyclable commodities (other than end users or processors) for resale. Both collectors and processors may use brokers to sell recyclable materials to end users.



Processors

Businesses that bale, crush, pelletize, compost, de-manufacture or otherwise change the form of the recyclable material for sale to an intermediate market or end manufacturer, including materials recovery facilities, scrap metal dealers.



End Users

Businesses that use recyclable materials as feedstock in the production of a new product. That includes paper, steel and aluminum mills but not companies which generate recyclable materials internally and reuse these materials.



Re-manufacturers

Business that remanufacture or reuse recyclable materials such as: furniture, white goods, computers and electronic appliances; used motor vehicle parts, tires, wood (e.g. pallet rebuilders). This category also includes retailers that sell used merchandise (e.g. charity shops)



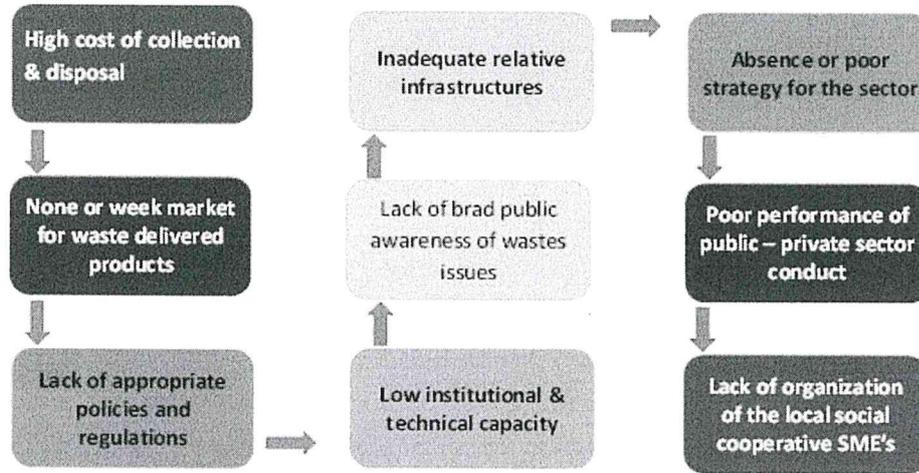
Recycling Equipment

Business that manufacture equipment used solely for the purpose of collection and/ or processing of recyclable materials for recovery and reuse.

Green-Crew Deliverable 5.2.2: Social impact analysis – 3

2. Green Entrepreneurship & Green Economy.

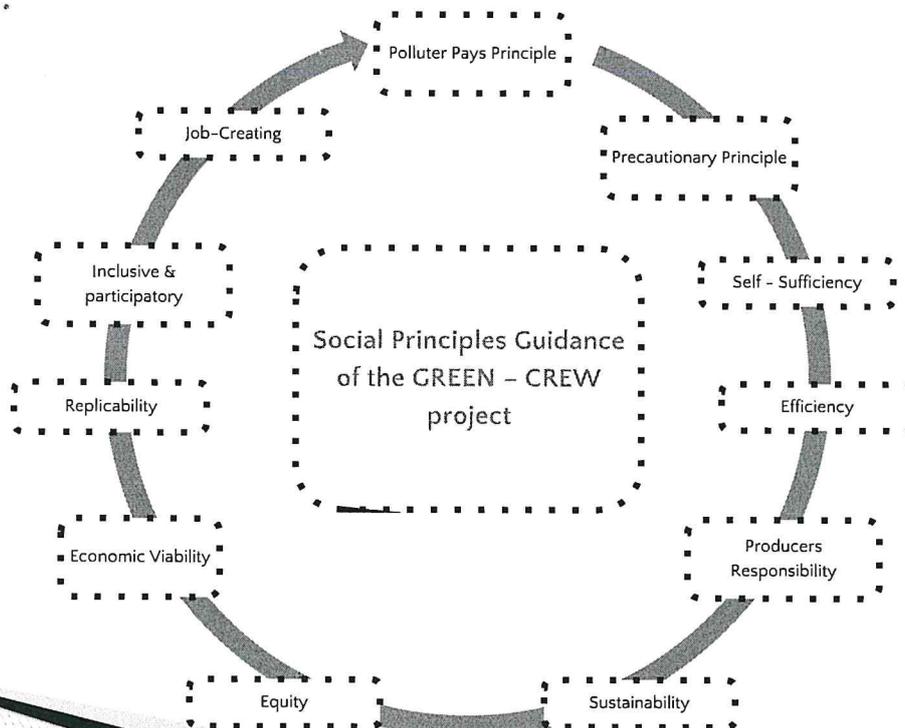
- Stimulating green innovation through a social lens.
- Identifying the Barriers for Realising a turn for a Greener Economy on the MSW sector at the projects area.



Barriers for greening the Municipal Solid Waste sector

Green-Crew Deliverable 5.2.2: Social impact analysis – 4

3. The Project “Green – Crew” and its approach for greening the wastes sector.



Green-Crew Deliverable 5.2.2: Social impact analysis – 5

Conclusions and highlights on the social impacts of the Green Crew project

1. It created a platform where different stakeholders were able to meet and learn in collaboration both informally and formally.
2. It augmented a number of local Authorities (e.g. Local Governance) to ensure the development of comprehensive, clear environmental policies addressing municipal solid waste management.
3. Disseminated to the regional cross-border area the updated EU policies and national / regional regulations relevant to the waste management.
4. The project conducted a package of tools for enforcement and compliance: legal, economic, communication and outreach.
5. It served as a mechanism that provided financial & technical support to local incentives in the form of Social Cooperatives to encourage moving towards greening the solid waste sector.
6. It utilized those incentives to change behaviour of local residents.
7. It accelerated innovation to meet the shared long-term SDGs through the contribution of technological innovation to fostering economic growth.

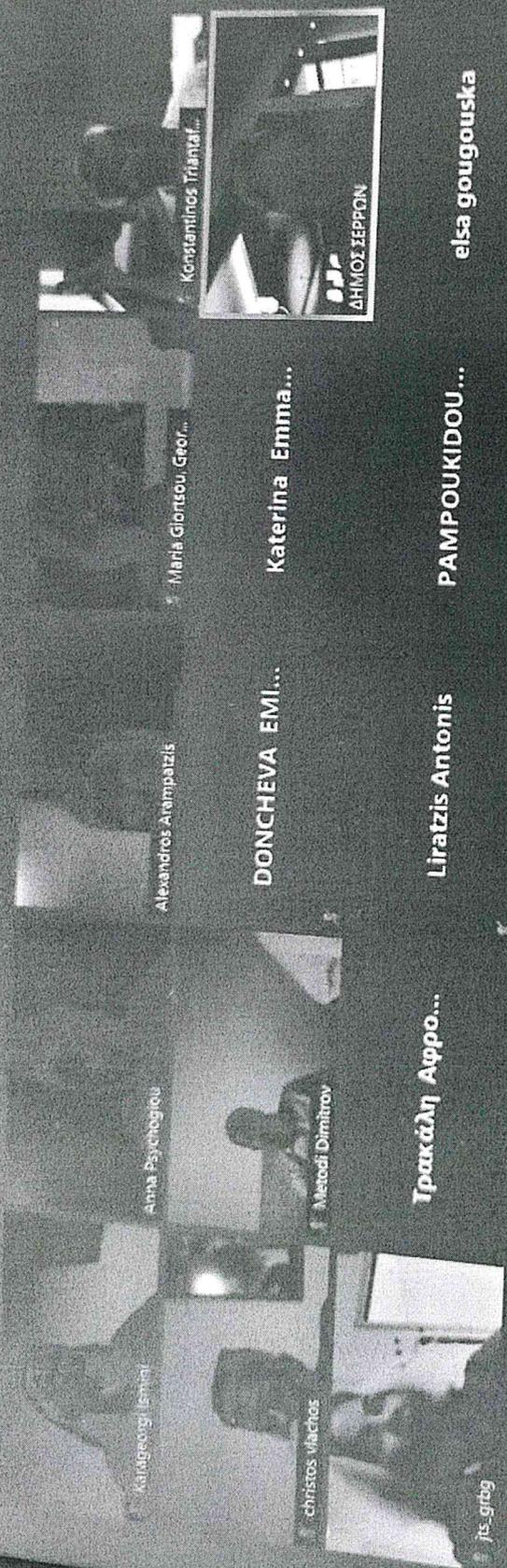
Project: Green Crew

MODERN WASTE MANAGEMENT & OPPORTUNITIES FOR SOCIAL ENTERPRISES

(SME's)
Always Recycle

Recycle Not Covid – 19

Be safe!!!



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Zoom Group Chat

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